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Effect of Selected Chemicals on Indiana Bats, Gray Bats, and Bald Eagles at Fort Leonard Wood, Missouri

Appendix IV to the Biological Assessment: Relocation of U.S. Army Chemical School and U.S. Army Military Police School to Fort Leonard Wood, Missouri

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Glossary

A

ACUTE EXPOSURE - A single exposure event

AEROSOL - A gaseous suspension of fine solid or liquid particles

ALIPHATIC - A molecule with a straight chain structure

ALKANE - A hydrocarbon having only single bonds

ALKENE - A hydrocarbon having one double bond

ALKYNE - A hydrocarbon having one triple bond

ALLUVIUM - Clay, silt, sand, gravel deposited by running water during recent geological time, ordinarily on floodplains of streams or at places where streams lose velocity.

AMSL - Above mean sea level

ANAEROBIC - Without air; in the absence of free oxygen

ANOVA - Analysis of variance; statistical analysis of two or more samples that tests variance among samples and interaction between samples.

ANTICLINE - An upfold or arch of stratified rock in which the beds or layers bend downward in opposite directions from the crest or axis of the fold.

AROMATIC - A molecule with ring structure

ASSESSMENT ENDPOINT - A quantifiable expression of the environmental value considered to be at risk

AUGER - A drill-like tool used to collect core samples of soil

B

BAF (Biological accumulation factor) - ratio of the concentration of a chemical in media to that in tissue

BCF (Biological concentration factor) - ratio of the concentration of a chemical in water to that in an aquatic organism

BIOACCUMULATION - The net accumulation of a chemical by an organism as a result of uptake from all routes of exposure

BIOAVAILABILITY - The proportion of an orally ingested substance that is absorbed into systemic circulation

BIOCONCENTRATION - In aquatic habitats, the net accumulation of a chemical by absorption from aqueous solution

BIOMAGNIFICATION - The accretion of substances as a result of food chain relationships

BOD_5 (Biological oxygen demand) - The amount of oxygen required to oxidize chemicals in a water sample by biological mechanisms

C

CANOPY - The top-most layer of plant growth

CHRONIC EXPOSURE - Multiple or repeated exposure events

CHRONIC REFERENCE DOSE - An estimate of daily exposure that is likely to be without appreciable risk of adverse effects during a lifetime

COD (Chemical oxygen demand) - The amount of oxygen required to oxidize materials in a water sample by chemical mechanisms

COLLUVIAL - Sedimentation of or deposition of particulate matter by the force of gravity

COMMUNITY - A collection of different and interacting populations within a specified location

CONCEPTUAL MODEL- A model (format) design that describes a series of working hypotheses of the manner in which a stressor may affect ecological components

CONDUCTIVITY - The capacity to propagate electrical charges

CONDUIT SYSTEM - In geology, a network of drainage passages for ground water.

D

DBH (Diameter at breast height) - the diameter of a tree measured at breast height

DECIDUOUS - A tree that sheds leaves or fruit at the end of a growing season

DEFORMATION - The process whereby rock is folded, faulted, sheared, or compressed by earth stresses

DIRECT EFFECT - (Ecological Risk Assessment Definition) An effect where a stressor acts on the ecological component of interest itself, not through effects on other components of the ecosystem

DISSECTED LAND - Land divided into hills and ridges by valleys and gorges

DISSECTION - The process of erosion whereby a land surface is cut by gullies, ravines, canyons, or other kinds of valleys

DISTILLATION - Separation of components in a solution by volatilization followed by condensation

DRAW - In geology, a low-lying area

DRIPLINE - Edge of a cave entrance where water runoff falls

E

EVENESS INDEX - An index describing the number of organisms in each species of a community, which gives an indication of diversity of the community

EXPOSURE PATHWAY - The course and mechanism by which a chemical agent transfers from a source to an exposed organism

EXPOSURE PROFILE - Characterization of exposure in the analysis component of ecological risk assessment for the receptor and stressor

EXPOSURE ROUTE - Part of an exposure pathway describing how a chemical comes in contact with an organism (i.e. oral ingestion, dermal absorption, or inhalation)

EXPOSURE - Contact between a stressor and an ecological component

F/G

FLASH POINT - The minimum temperature at which a substance will ignite

FOOT SLOPE - A shallow rise in terrain at the base of hills or mountains

FORD - A shallow, usually narrow part of a river that can be crossed by man or animal by wading.

GC/FID (Gas chromatography/flame ionization detection) - Methods used to separate and identify components of a sample

GC/MSD (Gas chromatography/mass spectrum detection) - Methods used to separate, identify, and quantify components of a sample

H

HARDNESS - Measure of calcium and magnesium salts dissolved in water

HAZARD INDEX - The sum of more than one hazard quotient for multiple stressors and exposure pathways

HAZARD QUOTIENT - Ratio of actual or predicted exposure concentration to concentration expected to have no adverse effect

HAZARD - A physical, chemical, or biological entity that has the capacity to cause harm

HC (Hexachloroethane; perchloroethane; carbon trichloride) - a type of smoke/obscurant used in pyrotechnics and smoke devices; solvents; explosives

HIBERNACULA - Cave or other site used by hibernating bats

HYDROCARBON - An organic compound consisting of carbon and hydrogen

HYDROLYSIS - Decomposition of a chemical compound brought about by reaction with water

HYDROTREAT - To chemically reduce a molecule by breaking double bonds and adding hydrogen atoms

I/J/K

INDIRECT EFFECT- (Ecological Risk Assessment Definition) An effect where a stressor acts on components of the ecosystem that in turn have an effect on a species or other component of concern

INTAKE - A measure of exposure expressed as the mass of a chemical substance per unit body weight of exposed organism per unit time

INVERSION LAYER - A layer of warm air that is trapped below a layer of cool air

IRIS (Integrated risk information system) - A database sponsored by the EPA that contains verified health risk information for numerous chemicals; a primary source of toxicity information for Superfund

ISOPLETH - Line of equal concentration; a line on a graph indicating stressor concentration at varying distances from the source

JACARD SIMILARITY INDEX - A measure of symmetry between 2 communities based on portion of species common to each community to the total number of species found in both communities

K_{ow} - Octanol/water coefficient

L

LC_{50} (Lethal concentration)-The concentration of a liquid or gas that is lethal to 50% of a population in experimental testing

LD_{50} (Lethal dose)- The dosage (oral) of a substance that is lethal to 50% of a population in experimental testing

LEACHATE- Soluble material removed from soil by percolating water

LENTIC- Flowing waters such as streams, rivers and creeks where water turbulence maintains most solids in the water column

LOAEL- Lowest observed adverse effect level

LOTIC - Pooled areas in any body of water where flow is slow and suspended solids fall to the bottom, especially ponds, lakes and reservoirs

M

MATERNITY COLONY - A group of reproductive female bats that gather at one roost to give birth and raise young

MEASUREMENT ENDPOINT - A measurable biological or ecological characteristic

MESIC - Characterized by a moderate amount of moisture

MESOPHYTES - Plants that grow under medium conditions of moisture

MOTTLED - Having patchy or spotted coloration

N

NOAEL - No observed adverse effect level.

NON-CARCINOGEN - A substance which does not cause cancer

NON-SYSTEMIC - Affecting portions of the body other than the organ systems

O

OBSCURANTS - Opaque smokes or mists used to obscure troops and equipment

ORGANOCHLORINES- Chemicals containing atoms of carbon and chlorine; often used as pesticides

P

PARAFINS - A group of saturated hydrocarbons

PARTURITION - Giving birth

PASQUILL STABILITY CATEGORY - An index of atmospheric disturbance, ranging from very unstable air to stable air

pH - Index of acidity of a solution; measurement of the number of hydrogen ions in solution

PHOTOLYSIS - Chemical decomposition resulting from the action of light

PLUME- Pattern of aerosol dispersion

POLAR - An uneven distribution of charges in a molecule

PRE-SETTLEMENT VEGETATION - Condition and composition of the forest prior to fragmentation and logging by modern man

PREVAILING WIND- Predominant wind direction at a locality

R

RCRA - Resource Conservation and Recovery Act of 1976

RECEPTOR - Organism exposed to the adverse effects of a stressor

REFERENCE DOSE (RfD) - A toxicity value for evaluating non-carcinogenic effects resulting from exposure to chemical or physical agents

RESIDENCE TIME - The time a given amount of substance remains in a designated compartment of a system

RESIDUUM - Remainder of sediment or precipitate.

RIPARIAN ZONE - Vegetation growing in the floodplain of a stream or river.

RISK - Adverse effect; hazard

RISK ASSESSMENT - Process that evaluates the likelihood of adverse effect due to exposure/contact with a stressor

S

SAFE CONCENTRATION - A concentration of a substance a receptor can be exposed and no adverse toxicological effects are expected to result to the receptor

SHANNON-WEINER DIVERSITY INDEX - A calculation that considers the number of species and abundance of each species to provide an index of species richness in a particular community

SHORT-LEAF PINE PLANTATION - A planting of *Pinus echinata*.

SOIL ASSOCIATION - A group of defined and named soils usually having different characteristics and regularly associated in a geographic pattern.

SOLUTION CAVITIES - A cavern eroded by rain water or slightly acidic ground water along joints or other opening in rock.

SPRING RECHARGE AREA - The drainage basin or area that contributes water to a spring.

SPSS - Statistical Procedures for Social Sciences

STAGING - Post-hibernation, pre-migration of bats near the hibernaculum

STRESSOR- Any physical, chemical or biological entity that can induce an effect which is usually adverse

SUCCESSION - The change in composition of an ecosystem as competing organisms and especially plants respond to and modify the environment leading to a relatively stable community

SUMMER NURSERY HABITAT - Habitat suitable to support reproductive females and neonates

SUPERFUND - The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA); a law that governs cleanup of hazardous waste sites

SWARMING - Pre-hibernation activity of bats near the hibernaculum during which most mating occurs

SYNCLINE - A trough of stratified rock in which the beds dip toward each other from either side

T

T-TEST - Statistical calculation that determines degree of similarity between two samples

TERATOGEN - Substance capable of causing birth or developmental defects

THRUST FAULT - A reverse fault in which the angle between the horizontal and the plane is small

THRUST-BELT - A series of thrust faults

TOXICITY BENCHMARK - Base level against which other toxicity levels are compared

TPH - Total petroleum hydrocarbons

TRELLIS DRAINAGE SYSTEM - Network of streams that drain perpendicularly into larger streams, usually formed between ridges of rock

TROPHIC HIERARCHY - A functional classification of taxa in a community that is based on feeding relationships: the sum of all levels in the food chain or web

TROPHIC LEVEL - Position of a species in the food chain or web

U/V/W

VOLANT - Able to fly

VOLATILE - Evaporating rapidly at normal temperatures and pressures

WINTER-SUMMER REVERSAL - Shift in the direction of air flow near a cave entrance caused by a seasonal change in air temperature outside the cave

X/Y/Z

XEROPHYTIC - Being naturally adapted to life and growth under limited water supply by means of specialized mechanisms that limit transpiration and store water.

Section 1
Introduction

Section I:

Introduction

The proposed Base Realignment and Closure (BRAC) action will involve moving the Chemical and Military Police schools from Fort McClellan Alabama to Fort Leonard Wood, Missouri. The Environmental Impact Statement (HBA 1996), addresses impacts of this action on the human environment. A major component of the BRAC action involves introduction of obscurant and simulant training to the Fort Leonard Wood environment. Military uses for obscurants (smoke) include screening, deception, and identification of equipment, facilities, and troops (Shinn et al. 1987). Training simulants are used by the military to instruct soldiers in recognition of dangerous, hazardous or toxic chemicals used by enemy forces in chemical and biological warfare.

Two federally endangered species, the Indiana bat (*Myotis sodalis*) and the gray bat *(Myotis grisescens)*, and one threatened species, the bald eagle *(Haliaeetus leucocephalus)* occur on Fort Leonard Wood. We performed this Ecological Risk Assessment (ERA) to comply with the Endangered Species Act, and in support of the BRAC Environmental Impact Statement (EIS). This report is an appendix to the Biological Assessment (BA) for Relocation of U.S. Army Chemical School and U.S. Army Military Police School to Fort Leonard Wood, Missouri. The ERA focuses on potential contaminants generated by Chemical and Military Police School training. Risks to endangered and threatened species estimated herein were based on either modeled or estimated exposure concentrations and literature-based toxicity values. Risks were used to determine direct effects to the species of concern. Indirect effects

were addressed qualitatively. We assessed effects to adults, juveniles, and other life stages of the Indiana bat, gray bat, and bald eagle. We evaluated:

- fog oil and terephthalic acid (obscurants),
- Biological Integration Detection Systems (BIDS) simulants,
- FOX Training simulants, including Persistent Chemical Agent Simulants (PCAS),
- non-specific simulants (Polyethylene glycol and titanium dioxide).

Fog oil has had several designations in its history which may lead to confusion. There are two types of fog oil, "old" fog oil and "new" fog oil. Fog oil also has letter designations used by the military for purchasing or issuing requests for production from manufacturers. Types A and B are "old" fog oil (also referred to as SGF 1) that were manufactured under specifications A and B before 1986. "New" fog oil, designated as type D, is also referred to as SGF 2 fog oil (Standard Grade Fuel 2). It is the primary material used by the military to produce smoke at Fort McClellan and other installations. Fog oil designated as D is currently used at Fort McClellan, Alabama. Fog oil type D or E will be used at Fort Leonard Wood. Fog oil types C, D, and E are chemically and structurally the same compounds. Differences are based in the specifications given to manufacturers.

Fog oil smoke is produced by passing fog oil into a heated air stream in a generator which expels the vaporized oil into the atmosphere. When the heated oil contacts the cooler air, it condenses into a dense fog or smoke. It is important to note that the oil is aerosolized, and not combusted or burned as the name "smoke" implies.

Terephthalic acid (TPA) will replace hexachloroethane (HC) smoke by fiscal year 1999. HC is being replaced by TPA because HC is a human carcinogen; human deaths have been associated with over-exposure to HC smoke. TPA is a safer smoke because it is noncarcinogenic. The combustion products of HC (zinc chloride, chlorinated organics, and phosgene) are more toxic than those of TPA (Muse et al. 1995). TPA is used in floating or ground smoke pots and grenades. TPA is ignited and burned to produce smoke. It is used alone or to fill in incomplete fog oil screens.

We also assessed BIDS (Biological Integrated Detection System) and FOX Training simulants. BIDS, mounted on a High Mobility Multipurpose Wheeled Vehicle (HMMWV) or

trailer, is an air sampling and detection system. Students are trained in detection and identification of biological weapons. FOX training activities include instruction on deployment and operation of the FOX vehicle and chemical detection system using simulated chemical agents. The FOX is a self-contained, amphibious vehicle with a mounted air sampling and detection system.

Non-specific simulants to be used at Fort Leonard Wood include polyethylene glycol (PEG 200) and titanium dioxide. PEG 200 is used by the military to simulate chemical warfare agents. Soldiers are exposed to an aerosol of PEG 200 and are required to decontaminate themselves and their equipment. Titanium dioxide is the major component of M82 grenades, used to simulate brass grenades. Both titanium dioxide and brass grenades produce smoke which obscures troops and equipment from infrared detection.

The objective of any ERA is to identify available chemical, toxicological, and ecological information and apply this information to approximate the probability of undesirable ecological effects (Wentsel et al 1994). We incorporate studies conducted for Fort Leonard Wood's Ongoing Mission Biological Assessment (3D/Environmental 1996b).

We define effects using measurement and assessment endpoints. We selected the measurement endpoints of toxicity tests, hazard quotients (HQ), and exposure point concentrations. We established a Hazard Quotient for each receptor for inhalation, ingestion, and dermal absorption exposure pathways. When the Hazard Quotient (HQ = TRV/exposure concentration) exceeds 1.0, we predict an adverse effect. Acute HQs describe the risk of a single exposure. Chronic HQs define the risk of exposure over the organism's lifespan.

Measurement endpoints included in this ERA address effects to individuals. Information is provided to allow for estimation of the number of individuals potentially affected by the BRAC action. No data is available regarding population measurement endpoints for receptors/stressors in this ERA. Fort Leonard Wood will monitor bald eagle, Indiana bat, and gray bat populations on the installation following implementation of the BRAC action.

We considered exposure to toxic concentrations of any stressor to be an effect (risk). Toxicological effects identified for each stressor are converted to toxicological values or doses (i.e. NOAEL = No Observable Adverse Effects Level) not expected to result in adverse health effects. Uncertainty factors (UF) account for anatomical, physiological, or morphological

differences between species for which the dose was calculated and the assessment endpoint. Toxicity Reference Values (TRV) were developed by applying uncertainty factors to the doses (TRV = NOAEL/Uncertainty Factors) following Department of Army guidelines (Wentsel et al 1994) and procedures outlined in Calabrese and Baldwin (1993). For fog oil, BIDS simulants, FOX Training simulants, and non-specific simulants, we determined acute and chronic toxicity from data available in the literature. For TPA, a computer model was used to determine acute and chronic toxicity (3D/Environmental 1996b).

We conducted a study at Fort McClellan to assess the dispersion and persistence of fog oil in the environment (3D/Environmental 1996a). A summary of this study and the BRAC EIS Preliminary Risk Evaluation Report, conducted on new fog oil to aid in determination of risks to the human population, is included in this document. We established 3 exposure sites and one reference site where we collected tissue and media samples. The samples were analyzed for hydrocarbons identified in fog oil. Samples were taken from fog oil generators to determine if the parent fog oil undergoes transformation when it passes through the generator. Interpretation of this data is incorporated into the ERA. None of the media samples (soil, surface water, or sediment) or tissue (tree bark, leaves, fish, insect, or bat) samples from exposure sites showed significant differences in concentrations of fog oil hydrocarbons when compared to the reference site values. Based on the Fort McClellan study, fog oil does not bioaccumulate, bioconcentrate, or remain in the environment for any extended period of time. We do not anticipate environmental accumulation of fog oil at Fort Leonard Wood. Analysis of fog oil smoke from M56 and M157 generators showed little if any aromatic compounds. This indicates that parent fog oil essentially remains unchanged after it is heated and vaporized in the generators.

We modeled dispersion and deposition of fog oil, TPA, and titanium dioxide. Concentrations derived from the models are used as exposure concentrations. To assess the potential for exposure, we investigated Indiana bat hibernacula (Davis No. 2 Cave, Joy Cave, Wolf Den Cave, and Brooks Cave), and gray bat caves (Freeman and Saltpeter No. 3), Indiana bat and gray bat foraging areas, potential Indiana bat maternity habitat, bald eagle wintering locations, and bald eagle nest locations as exposure points. We compared exposure points with estimated stressor concentrations and determined if a complete exposure pathway existed. If the pathway was complete, we characterized the risk associated with this pathway. Stressor behavior within caves was characterized by measuring air flow and atmospheric conditions inside, immediately outside, and at one bat roost location for each cave.

Section 2
Problem Formulation

Section II:

Problem Formulation

2.1 OBJECTIVES

This Ecological Risk Assessment (ERA) estimates the effects of proposed fog oil, terephthalic acid (TPA), Biological Integration Detection Systems (BIDS) simulants, FOX Training simulants, and non-specific simulants (polyethylene glycol and titanium dioxide) to three species. Toxicological effects from proposed BRAC actions were evaluated to determine risks for two federally endangered species of bats, Indiana bat (*Myotis sodalis*) and gray bat (*Myotis grisescens*) and a threatened species, bald eagle (*Haliaeetus leucocephalus*).

2.2 ASSESSMENT ENDPOINTS

Assessment endpoints are ecological values to be protected. Ecological values generally have either societal or economical significance, such as the Alaskan salmon fisheries. Alaskan salmon are a valuable natural resource and provide income to commercial fisherman. We selected the quantification of potential toxicological risks from chemical stressors to Indiana bats, gray bats, and bald eagles as assessment endpoints.

2.3 MEASUREMENT ENDPOINTS

Measurement endpoints are discrete values that can be assigned numerical values. Measurement endpoints selected here include: acute and chronic toxicity tests, NOAEL (No Observable Adverse Effect Level), LOAEL (Lowest Observable Effect Level), and LD_{50} (Lethal

Dose to 50% of the test population). We determined appropriate toxicological values and compared these to modeled exposure point concentrations (for acute HQs) and calculated intakes (for chronic HQs).

Measurement endpoints selected for this study do not address how receptor populations will be affected. The measurement endpoints we used show effects that are expected for individuals, such as kidney disease or mortality. We provide information about population densities that can be used to estimate the number of individuals affected. Population characteristics are generally inferred from characteristics of individuals (Suter et al. 1993). While population effects can not be predicted from toxicity tests alone, some conclusions can be made if the number of individuals affected is known. We can estimate the number of individuals that will develop kidney disease. We do not have measurement tools to describe effects to the population if for example, 6 individuals develop kidney disease. Knowing the number of individuals affected will not describe how the stressor will impact a population, or the persistence of the population. Measurement endpoints developed for chemical stressors analyzed in this ERA have not been established. Little information is available to assess toxicity of the stressors to receptors of concern. No data exists that can be used to establish a relationship between individual mortality or illness to population effects for the stressors in this ERA.

Because available data is insufficient to develop population measurement endpoints for the receptors of concern, Fort Leonard Wood will monitor Indiana bat, gray bat, and bald eagle populations. Management practices have shown populations of long-lived vertebrates such as large mammals and predatory birds are more sensitive to mortality imposed on adults than are short-lived, highly fecund organisms such as quail or rabbits. Indiana bats, gray bats, and bald eagles have relatively long lifespans and low fecundity rates. Most individuals in receptor populations are adults. Monitoring of the populations will allow the installation to accurately determine if the population dynamics are changing. Further investigations will be required to assess if detected changes in the dynamics or structure of the populations are the result of the BRAC action or other cause.

2.4 CONCEPTUAL SITE MODEL DEVELOPMENT

Figure 1 illustrates the relationship of stressors, receptors, and exposure pathways in this ERA. This conceptual site model depicts the three receptors as adults. We assessed effects by estimating how much stressor the receptor would intake and then comparing the intake concentration to concentrations expected to result in an effect. We assessed effects to adults and other life cycle stages. In addition to sensitive life stages, receptors may be more vulnerable to stressor effects during activities such as hibernating or foraging.

Risks were estimated using the Hazard Quotient (HQ) approach. We considered HQ values greater than 1 an effect. We calculated an acute (single exposure) and a chronic (lifetime exposure) HQ for each receptor and receptor life cycle stage for each stressor. The HQ provides a point estimate of risk for the exposure pathway, receptor/receptor activity, and stressor. Because of the complexity of the BRAC action, lack of accurate predictions of exact training locations, dates, and schedules, and the number of chemicals assessed in this ERA, it is impossible to perform any type of probabilistic risk estimate. HQs are commonly used in human health risk assessments for non-carcinogenic risks as well as Ecological Risk Assessments, and are an acceptable technique to estimate risk.

Receptors may be exposed to stressors through inhalation, ingestion, and dermal absorption pathways. These pathways are considered direct. Direct pathways are those where the receptor directly contacts the stressor. Effects from exposure to stressors through direct pathways are considered direct effects. We assessed direct effects quantitatively by calculating an HQ for each direct pathway. Indirect effects are those that are removed in time or space from the receptor. We did not quantitatively evaluate indirect effects such as reduction in prey by determining an HQ for the prey population. Indirect effects are addressed qualitatively in appropriate sections in this document.

HQs were calculated at exposure locations at various distances from chemical sources. This allows estimation of the number of receptors affected by each stressor. This approach is appropriate because we do not know exactly where receptors and stressor source points will be. We also assessed effects to receptors at stationary exposure locations such as a hibernacula.

We assessed effects from each stressor in this ERA to receptors by performing a screening level risk assessment. This screening level ERA was conducted by exposing receptors to the maximum concentrations (i.e. the total amount of the chemical to be released or used) for the exposure pathway most likely to reach the receptor. For example, if the stressor was released as an aerosol, we evaluated effects of the receptor inhaling the stressor. We adjusted the intake to reflect specific metabolic and physiological characteristics of each receptor. We considered the screening level risk assessment as worst case because we assumed any stressor contacted by the receptor would be inhaled, ingested, or absorbed. It is reasonable to assume if the worst possible exposure scenario for a particular stressor did not produce an HQ >1 (effect), lessor exposures would also not affect the receptor.

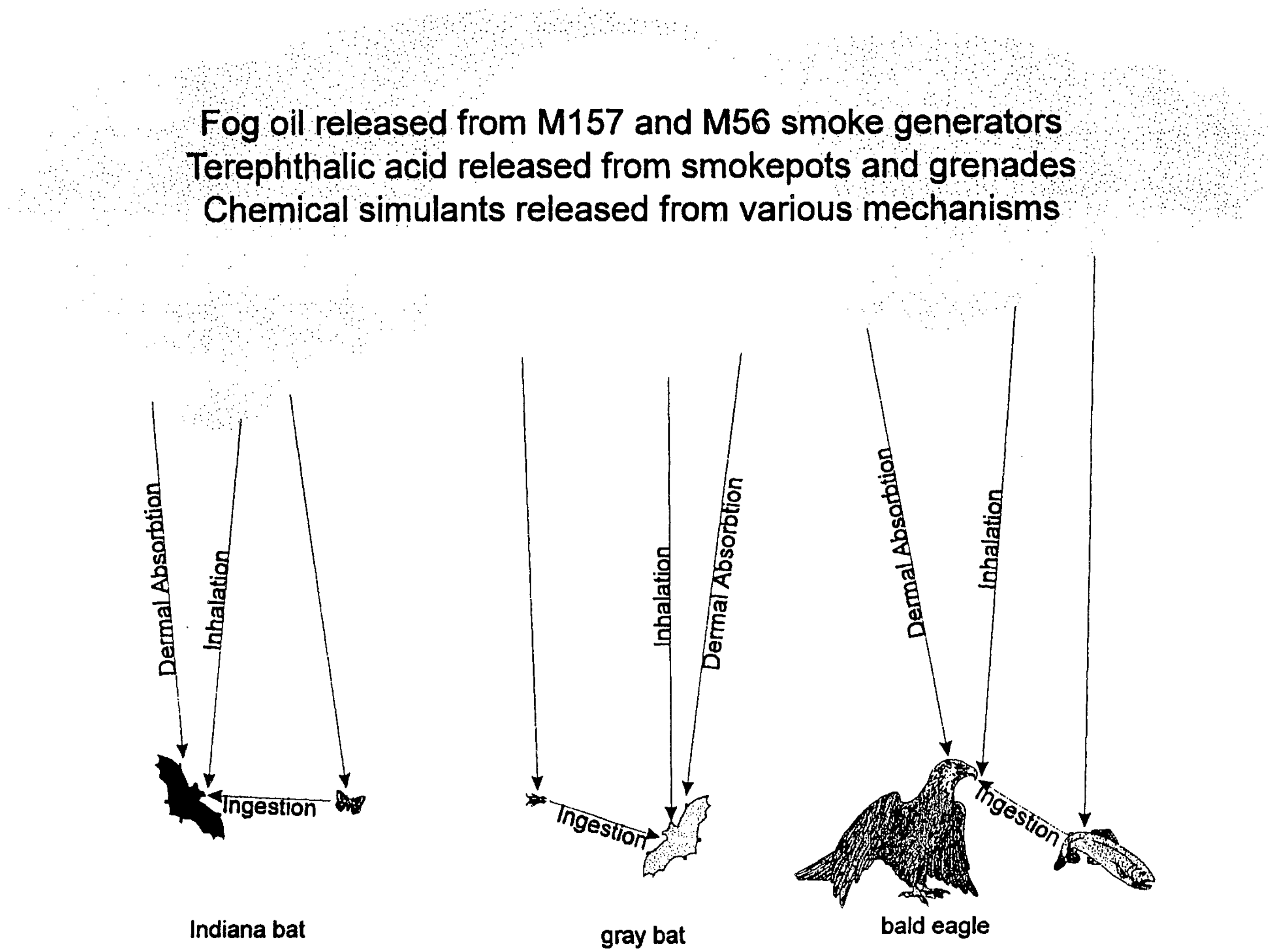


FIGURE 1. Primary exposure routes to the Indiana bat, gray bat, and bald eagle.

Section 3
Receptor Characterization

Section III:

Receptor Characterization

We examined the biology of each receptor species to determine when and where each is likely to be exposed to chemical stressors. Behavior and life history data were incorporated into calculations of chronic and acute intakes. We also compiled information on the distribution and density of receptors to evaluate the number of individuals impacted by proposed actions.

3.1 INDIANA BATS

3.1.1 Status and Range

Indiana bats (*Myotis sodalis*) were listed as endangered on March 11 1967 by the U.S. Department of the Interior, Fish and Wildlife Service (FWS). Legal protection is provided by the Endangered Species Act of 1973 (Public Law 93-205). A recovery plan for Indiana bats was published in 1983 by a FWS-sponsored Recovery Team (FWS 1983a). Briefly, the objectives of this plan are to:

- protect hibernacula
- maintain, protect, and restore summer nursery habitat
- monitor population trends through winter censusing
- educate the public
- continue research

Maintenance, protection, and restoration of summer habitat (including nursery roost sites and foraging habitat) are now recovery priorities.

Barbour and Davis (1969) describe the range of *M. sodalis* as the eastern United States, from Oklahoma, Iowa, and Wisconsin, east to Vermont, and south to northwestern Florida (Figure 2). This range includes both summer and winter habitat. The winter range is associated with regions of well developed limestone caverns. Major populations of Indiana bats hibernate in Indiana, Kentucky, and Missouri. Smaller populations are known from Alabama, Arkansas, Georgia, Illinois, Maryland, Mississippi, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Virginia, and West Virginia. Approximately 85% of the population hibernates in only 7 caves, and nearly 50% may hibernate in only 2 caves (FWS 1983a).

Across the range of the species, the Indiana bat population (as recorded from counts in hibernacula) has declined since the late 1970's. Declines have been most dramatic in Missouri, where the highest statewide population (353,000) was recorded by the Missouri Department of Conservation (MDC) in 1979. The 1991 Missouri population was approximately 54% of the recorded high (MDC 1995).

The Indiana bat is found statewide in Missouri (Figure 2). The state supports nearly 50% of all Indiana bats known to exist. The species has been captured during summer in 17 counties in Missouri, and probably raise young throughout the region. Twenty-nine caves, mostly in the Ozarks, are known to have contained hibernating colonies of at least 100 Indiana bats at some time in the past (Myers 1964, LaVal and LaVal 1980, Clawson 1987, MDC 1992).

The summer range of Indiana bats is more extensive than the winter range. In late spring, Indiana bat emerge from hibernacula and migrate to summering areas. Nursery colonies are formed under loose bark of trees or within tree cavities. Males are not present in nursery colonies, but roost individually under loose bark of trees. Males may also remain in or near hibernacula during summer months. Summer habitat includes forested upland and riparian sites.

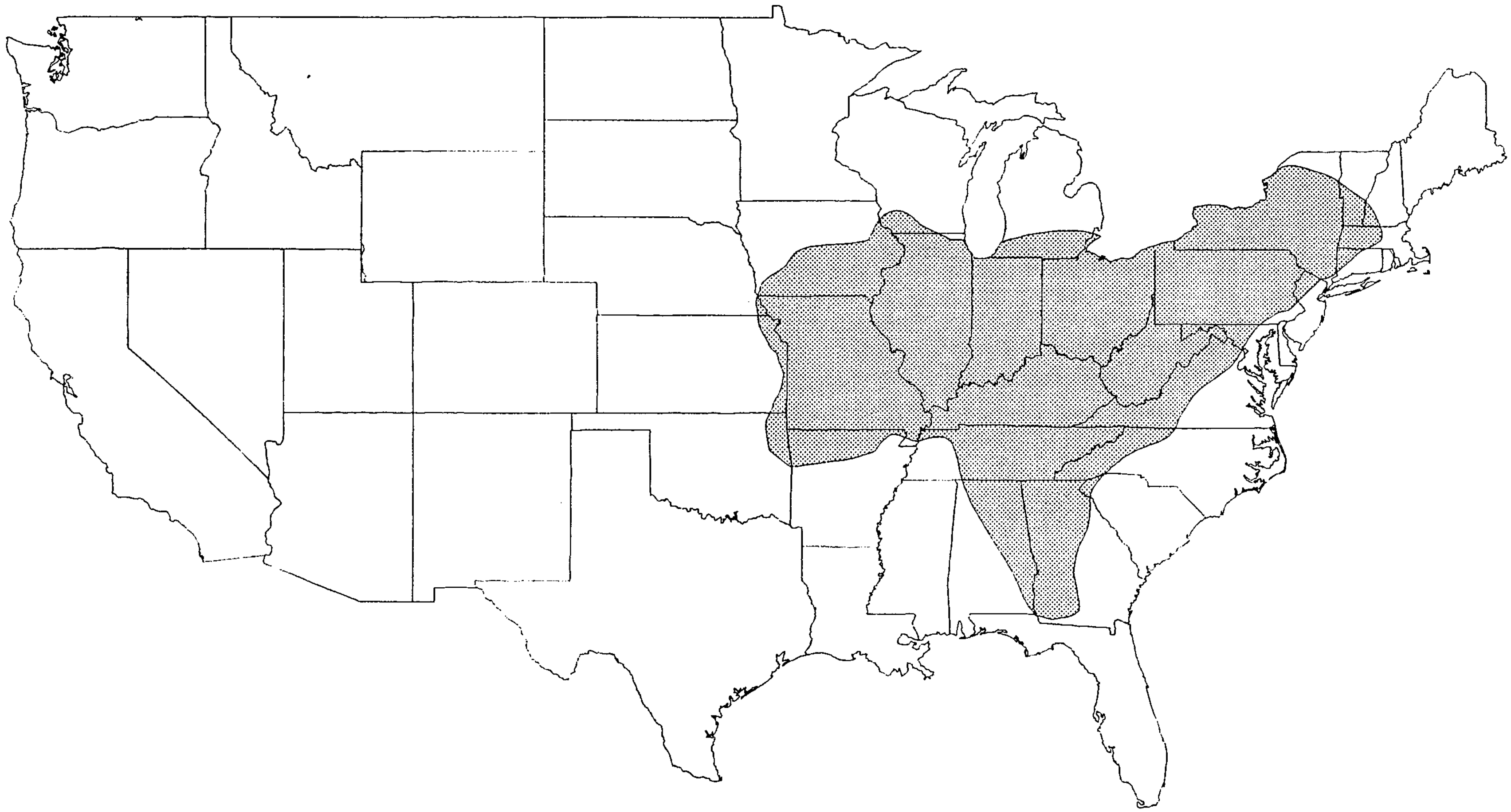


FIGURE 2. Range of Indiana bats in the United States (FWS 1983a).

3.1.2 Physical Characteristics

The Indiana bat is similar to other *Myotis*, but can be identified by a combination of physical characteristics including fur color, keeled calcar, and wing membrane attachment. Mean physical characteristics (Table 1) were used to determine surface area, food ingestion rate, and inhalation rate.

3.1.3 Life History

Indiana bats leave winter hibernating sites (hibernacula) over a two month period. This period of post hibernation activity prior to migration is called staging. Cope and Humphrey (1977) described changes in Indiana bat sex ratios during spring staging. Most Indiana bats staging in mid-April were female, while most males were still hibernating. The proportion of females detected in surveys of staging bats decreased through April as females migrated, and by early May, no females remained at the hibernaculum.

Peak departure for males occurs in early May. Some males remain near hibernacula throughout the summer. Whether or not male Indiana bats migrate, most are solitary during summer. Males roost in both upland and riparian areas and use many different roosts within a few days.

Female Indiana bats may migrate up to several hundred miles to establish maternity colonies. Females are pregnant when they arrive at summering areas. Maternity colonies are formed under exfoliating bark of dead trees, or living trees such as shagbark hickory *(Carya*

TABLE 1. Mean physical characteristics of Indiana bats and calculated intake rates.

Characteristic	Mean
Body weight	8 g
Total body length	83 mm
Forearm length	38 mm
Wingspread	254 mm
Surface area	0.022 m^2
Food ingestion rate	0.0025 kg/day
Inhalation rate	0.00034 m^3/day

ovata) in upland or riparian forests. A single maternity colony may consist of over 100 adult females (Gardner et al. 1991). Maternity colonies are found in a variety of other tree species, including slippery elm (*Ulmus rubra*), American elm (*U. americana*), cottonwood (*Populus deltoides*), northern red oak (*Quercus rubra*), post oak (*Q. stellata*), white oak (*Q. alba*), shingle oak (*Q. imbricaria*), sassafras (*Sassafras albidum*), sugar maple (*Acer saccharum*), silver maple (*A. saccharinum*), green ash (*Fraxinus pennsylvanica*), and bitternut hickory (*C. cordiformis*).

Parturition typically occurs between late June and early July. Lactating females have been caught between June 11 and July 6 in Missouri, from June 26 to July 22 in Iowa, and from June 11 through July 29 in Indiana (Brack 1983, Clark et al. 1987, Humphrey et al. l977, LaVal and LaVal 1980). Juveniles begin to fly between early July and early August.

Reproductive phenology is likely dependent upon seasonal temperatures and the thermal characters of roosts (Brack 1983, Humphrey et al. 1977). Like many other bats, Indiana bats are thermal conformists (Henshaw 1965), with prenatal, neonatal, and juvenile development heavily dependent upon temperature (Racey 1982, Tuttle 1975).

Autumn migration for Indiana bats begins in August. Swarming occurs when bats arrive at hibernacula. During swarming, many bats fly in and out of cave entrances (often hibernacula) from dusk to dawn. Caves may or may not be used for roosting during the day. Swarming is an important component in the life history of Indiana bats, as most mating occurs during this time (Hall 1962). Males arrive at hibernacula in August. Females begin arriving later and by September, numbers of swarming males and females are almost equal. By late September, many females have begun hibernation, and most swarming individuals are male. Their activities continue until mid-October or later, in an apparent effort to breed late arriving females (Cope and Humphrey 1977). Swarming chronology is thought to be dependent upon weather conditions including temperature and precipitation. Following swarming, Indiana bats hibernate in caves through winter.

Indiana bats hibernate from mid-November to mid-April in caves or mines with stable temperatures below 10°C, preferably from 4 - 8°C (FWS 1983a). Hibernating Indiana bats usually form dense (up to 300 individuals/square foot), clusters of thousands of individuals on

cave ceilings. These clusters include both males and females. Smaller clusters and individual hibernating Indiana bats are also common (Mumford and Whitaker 1982).

Hibernation facilitates survival during winter when prey are unavailable. However, hibernation requires sufficient fat storage to support metabolic processes until spring. Events that interrupt hibernation and increase metabolic rates pose substantial risks to hibernating bats.

3.1.4 Foraging Behavior

Indiana bats forage in upland and floodplain forests (Brack 1983, Humphrey et al. 1977, LaVal et al. 1977, LaVal and LaVal 1980, Gardner et al. 1991). Foraging activities of Indiana bats are generally concentrated from 6 to 90 feet (2 to 30 m) above the ground near the foliage of trees (Humphrey et al. 1977, Brack 1983). Indiana bats use stream corridors and forest openings as flight corridors from roosts to foraging areas.

Indiana bats may travel substantial distances from summer roosts to foraging areas. Gardner et al. (1991) found the maximum distance an Indiana bat traveled from a summer roost tree to a foraging area was 4 km. LaVal and LaVal (1980) observed male Indiana bats flying at least 5 km from summer cave roost sites to foraging areas. During the fall swarming period Indiana bats were observed foraging up to 2 km from their roost caves in eastern Missouri (LaVal et al. 1977). 3D/Environmental (1996b) provides a comprehensive literature review of Indiana bat foraging behavior and summer habitat.

3.1.5 Prey Selection

We reviewed prey selection by Indiana bats (3D/Environmental 1996b). Indiana bats consume a variety of insect Orders (Table 2) with moths and beetles dominant components of their diet.

TABLE 2. Orders of insects eaten by Indiana bats.

Order	Common Name	Life Stages
Lepidoptera	Moths	Terrestrial
Diptera	Flies	Terrestrial & Aquatic
Coleoptera	Beetles	Terrestrial & Aquatic
Trichoptera	Caddisflies	Aquatic
Ephemeroptera	Mayflies	Aquatic
Homoptera	Plant hoppers	Terrestrial
Plecoptera	Stoneflies	Aquatic
Neuroptera	Net-veined insects	Terrestrial
Hemiptera	Bugs	Terrestrial
Hymenoptera	Wasps	Terrestrial

3.2 GRAY BATS

3.2.1 Status and Range

Gray bats *(Myotis grisescens)* were listed as endangered on April 28, 1976 by the U.S. Department of the Interior, Fish and Wildlife Service (FWS). A recovery plan was published in 1982. Objectives of this plan are to:

- acquire and protect hibernacula and maternity caves,
- control habitat destruction,
- educate the public,
- continue research.

The gray bat occupies a limited geographic range in limestone karst areas of central and southeastern United States (Figure 3). Most occurrences are known from Alabama, Arkansas, Kentucky, Missouri, Tennessee, Florida, Georgia, Kansas, Indiana, Illinois, Oklahoma, Mississippi, Virginia, and North Carolina (Barbour and Davis 1969, FWS 1982).

Missouri contains approximately 20% of all gray bats known to exist. Because gray bats roost in caves year-round, its distribution in Missouri is closely tied to the availability of suitable roost caves. In Missouri, suitable caves are found primarily throughout the Ozark uplift, but some gray bats may be found northeast and west of the Ozarks. Currently, 33 - 36 maternity colonies are active, although nearly twice that number may have existed in the past (Myers 1964, LaVal and LaVal 1980, Clawson 1986, MDC 1992).

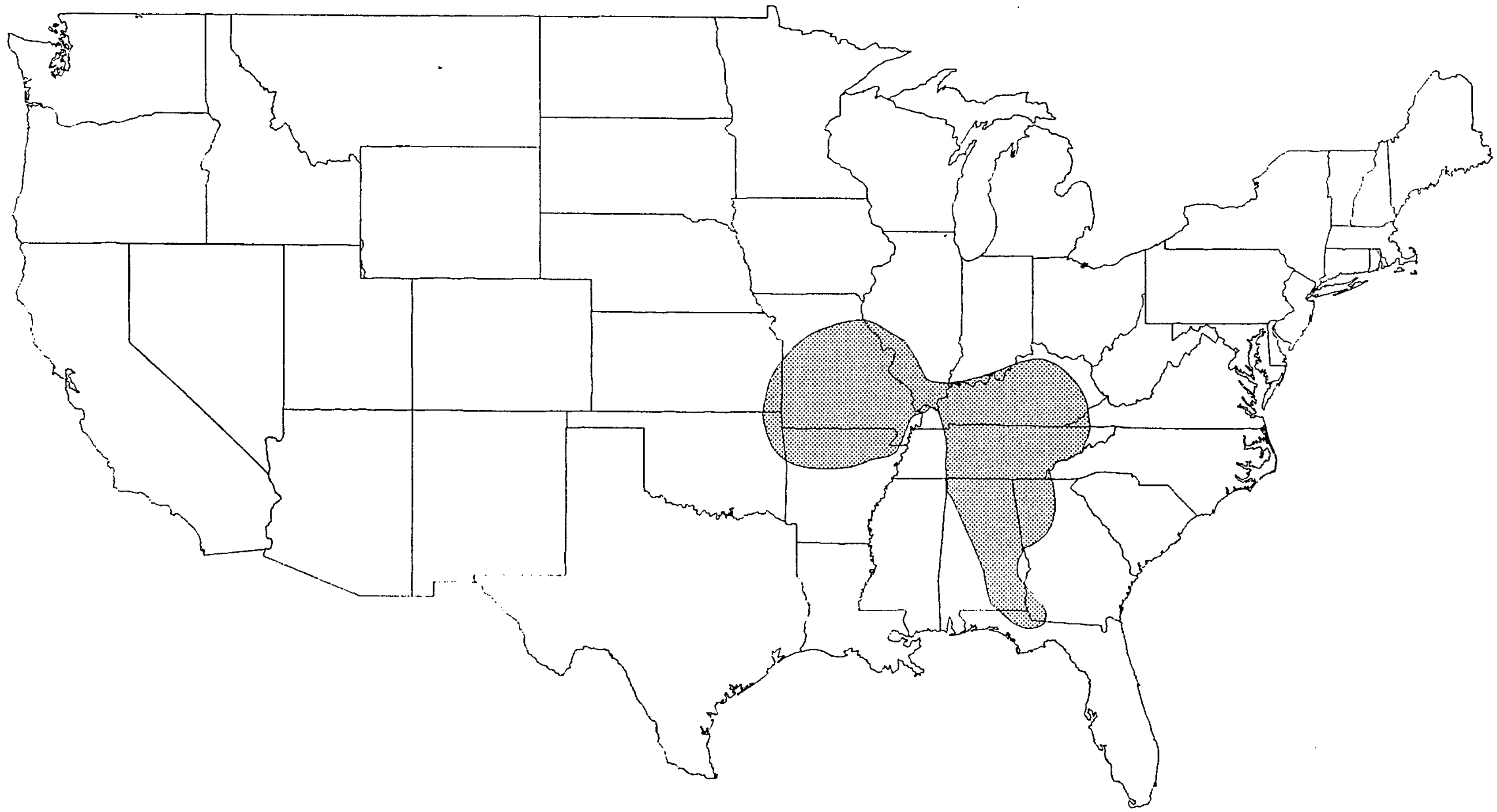


FIGURE 3. Range of gray bats in the United States (FWS 1982).

3.2.2 Physical Characteristics

The gray bat is similar to other *Myotis*, but can be identified by a combination of physical characteristics including large body size, pelage color, unkeeled calcar, wing membrane attachment at the ankle, and notched claws. Mean physical characteristics (Table 3) were used to determine surface area, food ingestion rate, and inhalation rate.

3.2.3 Life History

Unlike many other species of North American *Myotis*, gray bats inhabit caves in summer and winter. Gray bats may be more restricted to cave habitats than any other U.S. mammal (Tuttle 1979). Most gray bats migrate seasonally between hibernacula and maternity caves. Gray bats have been reported to migrate up to 326 miles (Tuttle 1976). Migration allows gray bats to utilize caves with optimal conditions for hibernating and raising young. Hibernacula are typically structured such that cold air enters in winter. Compared to Indiana bats, gray bats tend to hibernate in slightly warmer (7 - 10°C) portions of caves.

Like Indiana bats, gray bats exhibit swarming and staging behavior. Mating occurs when gray bats arrive at hibernacula in autumn. Females begin hibernation between early September and early October. Males remain active for several weeks following mating to restore fat reserves. Most juveniles enter hibernation by early November. Gray bats hibernate in large, loose clusters that may have more than a single layer (Barbour and Davis 1969).

TABLE 3. Mean physical characteristics of gray bats and calculated intake rates.

Characteristic	Mean
Body weight	10.5 g
Total body length	87 mm
Forearm length	43 mm
Wingspread	288 mm
Surface area	0.026 m^2
Food ingestion rate	0.0025 kg/day
Inhalation rate	0.00034 m^3/day

Female gray bats store sperm throughout the winter and become pregnant soon after emergence from hibernation (Guthrie and Jeffers 1938). In late March or early April, females begin migration, followed by juveniles and males between mid-April and mid-May. Migration is a significant source of mortality for gray bats, especially juveniles (Tuttle and Stevenson 1977). When they first arrive at summer areas, both males and females use the same transient caves. By mid-May, pregnant females move from transient caves to maternity caves (LaVal and LaVal 1980). Maternity caves are typically within 1 km a river or lake, and often have a stream running through them (Tuttle 1976). Most foraging occurs within 11 km of roosts (LaVal et al. 1977).

Females give birth to a single young in late May or early June. Once young are born, females leave their young in the cave while they forage (Barbour and Davis 1969). Most males and nonreproductive females utilize non-maternity caves during May - July. Lactation typically ends by late July and most young are volant within 20 - 25 days of birth. By late July, most females and juveniles leave maternity caves (LaVal and LaVal 1980). Maternity caves are often used as transient caves after this time.

During late July and August, gray bats of mixed ages and sexes are found in many caves throughout the summering area; individuals frequently move among caves (LaVal and LaVal 1980). In September, females begin to congregate at transient caves and by the end of the month most have left for hibernacula (LaVal and LaVal 1980). Males remain in summering areas later than females. Most males leave the summering areas by November; however a small number of males may hibernate in summer transient caves (LaVal and LaVal 1980).

3.2.4 Foraging Behavior

Gray bats forage predominantly over waterways, including rivers and lakes. Individuals are loyal to their colony home range, but may utilize several caves within the home range. Newly volant young often forage in forests surrounding the maternity cave.

A variety of stream sizes, as well as reservoirs, have been reported as foraging areas for gray bats (Clawson 1984, LaVal and LaVal 1980, LaVal et al. 1977). Larger areas of streams seemed to be preferred although even the smallest of perennial streams were used (LaVal et al. 1977).

Gray bats sometimes fly great distances to forage. In eastern Missouri, gray bats were captured foraging a mean distance of 11.1 km from the cave of banding (LaVal et al. 1977). Bats netted over streams were recaptured at caves a mean distance of 12.6 km from the original capture site (LaVal et al. 1977). LaVal and LaVal (1980) reported a maximum upstream dispersal distance of 20.8 km from a cave. They also reported gray bats flying cross country as far as 24.8 km from a cave to a lake. Thomas and Best (in press) report a gray bat traveling 75 km from one cave to another.

Once a gray bat reaches its foraging area, it may remain within a limited stretch of stream or section of a lake for the remainder of the evening. Along a stream in Missouri, LaVal et al. (1977) noted individuals foraging in an area less than 1.0 km in length.

3.2.5 Prey Selection

Gray bats consume insects from both aquatic and terrestrial habitats. A review of gray bat diet studies is provided in Exhibit B, Appendix II of the Biological Assessment of the Master Plan and Ongoing Mission (3D/Environmental 1996b). Reproductive females appear to consume predominantly aquatic insects (Brack et al. 1994, Clawson 1984, LaVal and LaVal 1980), while juveniles foraging in terrestrial habitats consumed greater proportions of terrestrial insects. When adults forage in terrestrial habitats, moths and beetles appear to be important food sources.

3.3 BALD EAGLES

3.3.1 Status and Range

The bald eagle *(Haliaeetus leucocephalus)* was listed as endangered in 1978 by the U.S. Fish and Wildlife Service. Legal protection is provided by the Endangered Species Act of 1973 (Public Law 93-205). Recovery plans were developed by the FWS for northeastern and southeastern regions. Recovery tasks fall into four general categories:

- determine current population and habitat status
- determine minimum population and habitat needed to achieve recovery
- protect, enhance, and increase bald eagle populations and habitats
- establish and implement a coordination system for information and communication.

In 1980, only 1250 nesting pairs of bald eagles were known. Loss of habitat, shooting, trapping, toxic effects of organochlorine insecticides (Dieldrin, Endrin, DDT), and lead shot poisoning have contributed to the decline of the species. In recent years, bald eagle populations have been progressing toward species recovery. On July 12, 1995 the FWS changed the status of the bald eagle from endangered to threatened in the lower 48 states (50 CFR 17, Vol. 60).

Bald eagles are the only species of eagle with a distribution restricted to the North American continent (Grossman and Hamlet 1964). The range of bald eagles extends from the Florida coast northward to Alaska (Figure 4). Although the historic and current range of bald eagles in the United States are essentially the same (Snow 1973), current populations are much smaller.

There were 19 (11 established, 8 newly productive) successful bald eagle nests in Missouri in 1995, fledging 38 young (Wilson pers. comm. 1996). One of the 8 newly productive nests was located in Pulaski County. An additional 5 nests were active but not productive. Bald eagle production has shown a dramatic increase since 1984 when there were no known productive nests in the state. A total of 2368 bald eagles were counted during the statewide 1995 mid-winter bald eagle survey.

3.3.2 Physical Characteristics

The bald eagle is a large bird of prey. Adults, with characteristic white head and tail plumage, are easily identified. Immature eagles up to 5 years of age have a mottled brown coloration and often are confused with golden eagles *(Aquila chrysaetos)*. Mean physical characteristics (Table 4) were used to determine surface area, food ingestion rate, and inhalation rate.

3.3.3 Life History

Wintering bald eagles migrate in response to adverse weather conditions and limited food availability. Winter habitats typically are near a readily available food resource. Bald eagles reach maximum densities in areas of minimal human activity and are almost never found in areas of heavy human activity (Peterson 1986).

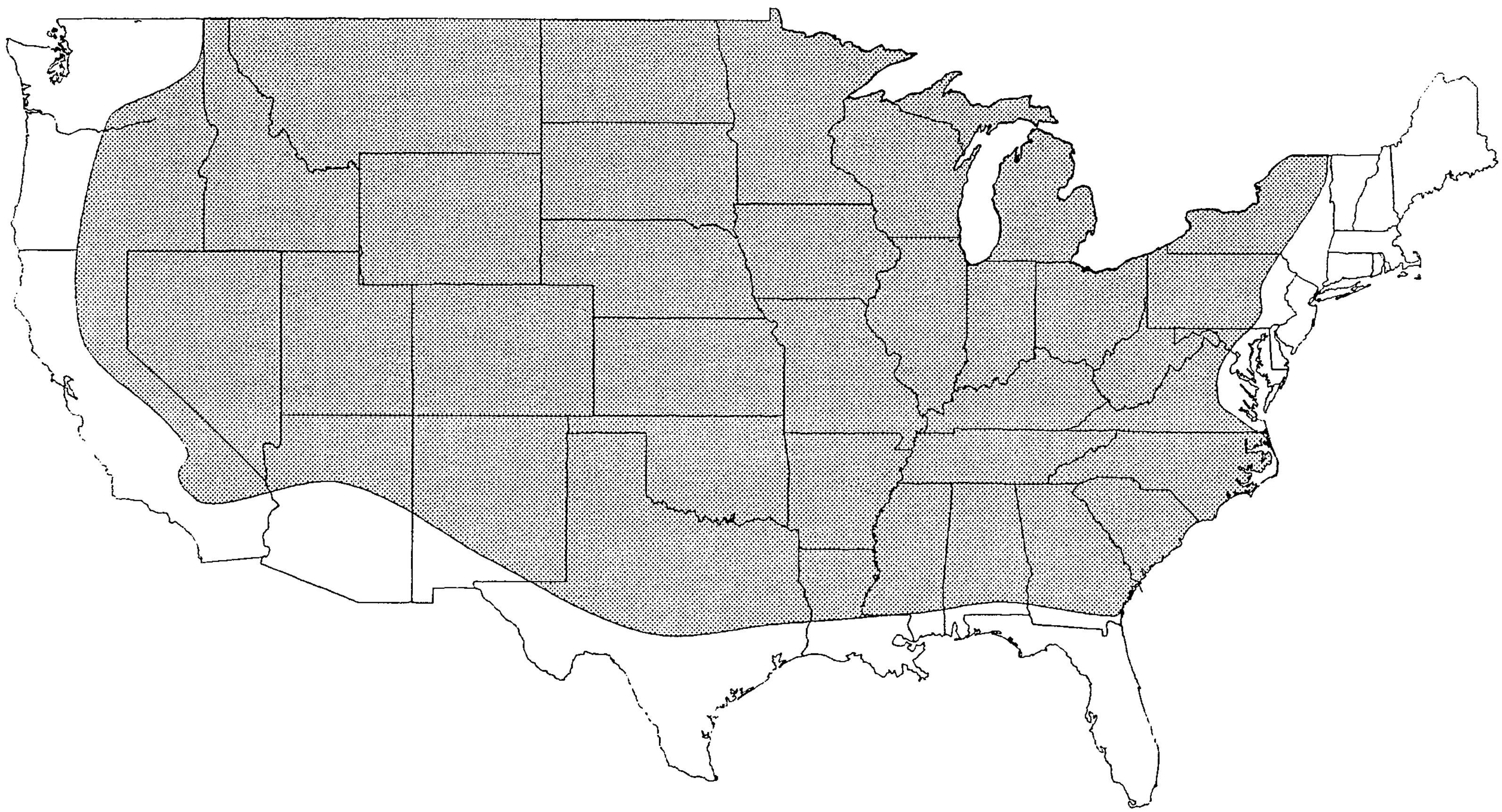


FIGURE 4. Winter range of bald eagles in the United States (ODNR 1982).

TABLE 4. Mean physical characteristics of bald eagles.

Characteristic	Mean
Body weight	4500g
Total body length	86 cm
Wingspread	239 cm
Surface area	0.275 m^2
Food ingestion rate	0.292 kg/day
Inhalation rate	1.31 m^3/day

Eagles roost at night, communal or singly, in areas sheltered from extreme weather and human disturbance. Typical night roosts are in mature trees with heavy limbs and an open branching pattern. The roosts may be miles from foraging areas or feeding perches frequented during the day (Green 1985). Several authors described characteristics of preferred roost sites (Lish and Lewis 1975, Steenhof et al. 1980, Grubb et al. 1989). Mature trees with large open crowns and stout, horizontal perching limbs are preferred for roosting in general (Anthony et al. 1982, Stalmaster 1980). Roost trees are of various species, but usually are large and sheltered from prevailing winds. During migration and in winter, conifers often are used for communal roosting both during the day and at night, perhaps to minimize heat loss (Stalmaster 1980, Anthony et al. 1982). Grubb et al. (1989) observed bald eagles changing roost sites every 3 to 4 nights. Preferred roosts may become "traditional" communal roosts that are used by more than one eagle for many years. Edwards (1969) observed birds flying several miles after foraging to return to communal roosts. When human disturbance of a night roost occurs, birds may abandon the location (Steenhof 1976).

Bald eagles reach maturity at 3 - 5 years of age. Most bald eagles begin to breed in their fifth year. In Midwestern states, pair bonds are formed and breeding occurs from January to March. Bald eagles are commonly said to mate for life, but there are little supporting data. Characteristics of preferred breeding sites include proximity to large bodies of open water and an open, discontinuous canopy (Andrew and Mosher 1982, Anthony et al. 1982, Grubb 1980, Peterson 1986). In an analysis of more than 200 nests, Grubb (1980) found 55% 46 km, and 92% within 183 km of a shoreline. Eagles construct nests of sticks in the top third of trees that have overhanging branches providing cover from sun and inclement weather (Green 1985). Adults tend to use the same breeding area, and often the same nest, each year.

Nesting phenology depends largely on latitude. Egg laying ranges from November in Florida to May in Alaska. Females lay one clutch per year yielding 1 - 3 eggs. The number of eggs is reduced in years when environmental conditions are poor or when the female is in poor health. Replacement clutches may be laid (Sherrod et al. 1987). The entire breeding cycle, from initial activity at the nest through the period of fledgling dependency is about 6 months. Incubation lasts approximately 35 days, and young fledge 10 to 14 weeks after hatching. Successful pairs usually raise one to two young, occasionally three, per nesting attempt.

3.3.4 Foraging Behavior

In general, bald eagles are opportunistic feeders and take advantage of whatever food source is most plentiful and easy to scavenge or capture. Winter foraging areas and diurnal perches often are near streams, lakes, or other bodies of water. Eagles forage in upland areas in the winter when surface waters are frozen, consuming carrion including rabbits, squirrels, and dead domestic livestock such as pigs and chickens (Brown and Amadon 1968, Harper et al. 1988). Bald eagles also may steal food from other eagles as well as from hawks, osprey, gulls, and mergansers (Grubb 1971, Jorde and Lingle 1988). This may occur when there is a shortage of a primary food source (Jorde and Lingle 1988).

3.3.5 Prey Selection

Bald eagles eat dead or dying fish when available, but also catch live fish swimming near the surface or in shallow waters (Brown and Amadon 1968). In many areas, especially in winter, dead or injured waterfowl and shorebirds are an important food source (Todd et al. 1982).

Because bald eagles scavenge dead or dying prey, they are particularly vulnerable to environmental contaminants and pesticides. Eagles may feed on birds that died from pesticides or consume lead shot from waterfowl that were killed or disabled by hunters (Henny and Anthony 1989, Harper et al. 1988, Lingle and Krapu 1988). Bald eagles are vulnerable to biomagnification of contaminants within the food chain. Near Lake Superior (Wisconsin), over 20% of nesting pairs of bald eagles consumed herring gulls, which were found to be a significant source of PCB intake for eagles (Kozie and Anderson 1991). The gulls contained higher contaminant levels than local fish because gulls occupy a higher trophic level. A food

chain and chemical exposure pathway analysis for bald eagles is provided in the exposure assessment.

Section 4
Site Description

Section IV:

Site Description

4.1 FORT LEONARD WOOD

4.1.1 Geomorphology

Pulaski County, Missouri, is within the Ozark Plateau Province covering 40,000 square miles between the Missouri, Mississippi and Arkansas rivers. The plateau is on a broad uplift called the Ozark dome, and is bordered by lowlands. The province is divided into four sections: St. Francois Mountains, Salem Plateau, Springfield Plateau, and the Boston Mountains. Pulaski County is in the Salem Plateau section. Much of Pulaski County is less than 1200 feet in elevation, except in the Boston Mountain area (Thornbury 1965).

The Salem Plateau encircles the St. Francois Mountains and is widest on the northwest, west, and southwest sides (Thornbury 1965). Salem Plateau rocks originate in the Ordovician and earlier periods. In the western portion, there are limited areas of rock from Silurian, Devonian, and Mississippian periods.

The Salem Plateau is deeply dissected (100 - 500 ft) by small waterways. Deep dissections are more common in the southern part of the Plateau (Thornbury 1965). Adjacent to the St. Francois Mountains, some dissections reach Precambrian rocks. On Fort Leonard Wood, the land surface is deeply incised by waterways, particularly the Big Piney River and Roubidoux Creek. Action of water and uplift of the Ozark plateau promoted formation of many

caves on Fort Leonard Wood. The bedrock of the Roubidoux formation, a brown sandstone, is exposed in many places (Oesch and Oesch 1986). Caves on Fort Leonard Wood formed in Gasconade dolomite strata. Roubidoux sandstone forms the ceilings of many caves on Fort Leonard Wood (Oesch and Oesch 1986). More than 40 caves are known on the installation. Presence of numerous sinkholes on Fort Leonard Wood suggests undiscovered caves or solution fissures exist underground.

4.1.2 Soils

Five major soil associations occur in Pulaski County: Nolin-Huntington-Kickapoo, Clarksville-Gepp, Viration-Clarksville-Doniphan, Lebanon-Plato, and Poynor-Ocie-Gunlock (Table 5).

4.1.3 Groundwater

Groundwater in the Ozarks occurs in bedrock. Ozark underground rock is primarily carbonates and interbedded sandstones that allow vertical leakage between rock layers. Numerous fractures cause flow systems to be complex. Because water exchange is high, individual layers are not identified as aquifers (Harris 1979).

Large springs are the primary method of groundwater discharge in the Ozarks. Twelve of the 69 large springs in the United States and numerous small springs are found in the Ozarks (Thornbury 1965). Smaller springs and seeps are major water suppliers for stream and river systems. Surface water and ground water are closely related in the Ozark Plateau (Stout and Hoffman 1973). Streams and rivers lose water through their beds, charging the ground water which fuels the springs. Springs, in turn, discharge to rivers and streams.

Groundwater is available from several rock layers under the Installation. The Potosi Dolomite formation located 50 - 60 feet AMSL (800 - 1000 ft below the surface) produces the most groundwater. Two wells west of Lieber Heights family housing area tap this aquifer for average yields of 320,000 gallons per day. The U.S. Geological Survey (USGS) indicates wells drilled to mean sea level are expected to produce 300 to 400 gallons per minute. The quality of the groundwater is good (HBA 1995).

TABLE 5. Descriptions of major soil associations occurring in Pulaski County, Missouri (Wolf 1989).

Association	Location and Description
Nolin-Huntington-Kickapoo	Silty and sandy loam soils that occur on flood plains along the Big Piney River and Roubidoux Creek. Flood plains average approximately 1000 ft wide. Steep slopes and very steep uplands border flood plains. Minor soils within this association include Cedargap, Claiborne, Hartville, and Moniteau.
Clarksville-Gepp	Very cherty, cherty and stony soils on uplands, dissected slopes, narrow ridgetops, and high benches. Occurs on deep, moderately steep to very steep slopes. Somewhat excessively drained and well drained. Valleys within these areas are deep and narrow and no more than 700 ft wide. Cedargap and Claiborne are minor soils within this soil association.
Viration-Clarksville-Doniphan	Silty and very cherty soils on bluffs and dissected uplands beyond river valleys (most of Cantonment). Occurs on deep, gently sloping to steep slopes. Moderately well drained to somewhat excessively drained. Soils are dominantly silty on loess-covered ridges and very cherty soils on slopes. Minor soils include Cedargap soils.
Lebanon-Plato	Silty soils in the center of Big Piney/Roubidoux interfluve and moderately sloping uplands in northern portion the installation. Found on deep, gentle, moderate slopes. Moderately well drained and somewhat poorly drained. Gatewood, Doniphan, and Ocie soils are minor soils within this association.
Poynor-Ocie-Gunlock	Cherty and very cherty soils that make up approximately 22% of Pulaski County. Deep, gently sloping to steep, well drained and moderately well drained on uplands and terraces. Minor soils include Doniphan, Gatewood, Razort, and Viration soils.

4.1.4 Surface Water

Most of Pulaski County lies within the Gasconade River Watershed. The area covers approximately 3600 square miles and drains into the Missouri River (Stout and Hoffman 1973). Part of the county, including Fort Leonard Wood, lies within the Big Piney River watershed, which drains into the Gasconade River (Stout and Hoffman 1973).

Fort Leonard Wood is drained by Roubidoux Creek and the Big Piney River. Both are fast-moving, clear streams with large pools and gravel stream beds. These streams have cut

deeply into the landscape, causing deep valleys and high bluffs. Both streams flow northward to the Gasconade River which drains into the Missouri River.

The Big Piney River has a drainage area of 768 square miles. Fort Leonard Wood is downstream of 580 square miles of the watershed. Daily flow records, collected by the USGS River since 1921, show the average flow rate of the Big Piney River is 354 MGD (45 - 21,140 MGD; Harris 1979).

Roubidoux Creek traverses the western border of Fort Leonard Wood. The creek runs above ground at the southwestern corner of the reservation, disappears underground, and reappears as Roubidoux Spring further downstream (HBA 1995).

The only spring on the installation tested for flow rate and water quality is Stonemill Spring. The spring produces approximately 18.7 MGD and has been developed as a recreational fishing area. The USGS reports at least two other springs near the installation boundary (HBA 1995). Man-made, stationary bodies of water on the post include: Bloodland Lake; Penns Pond, a training lake at TA 250; and numerous impoundments near Normandy Training Area. Wetlands on the post are still under study (HBA 1995).

4.1.5 Climate/Atmosphere

Missouri is an inland state with a continental climate. Missouri receives cold air from Canada; warm, moist air from the Gulf of Mexico; and dry air originating in the west (NOAA 1978).

Pulaski County has a humid continental climate with hot summers and cold winters. Average temperatures range from 18°F to 46°F in winter and 64°F to 90°F in summer. Annual precipitation averages 42 in (24 - 66 in). Average annual snowfall is approximately 20 inches (Wolf 1989).

4.1.6 Natural Resources

4.1.6.1 Vegetation and Physiographic Region

Pulaski County is located within the Oak-Hickory Forest region of the Interior Highlands. Forests of the Ozark Plateau are principally different species compositions of oak, with or

without hickories. Oak-Hickory and Oak-Pine forest are dominant over most of the Salem Plateau section of the Ozark Plateau (Braun 1950).

Regionally, broad uplands or narrow upland ridges are common, while rocky barrens and limestone glades are local features. Larger streams have cut deeply valleys, cliffs, and talus slopes. A community of post oak (*Quercus stellata*) and blackjack oak (*Q. marilandica*) occurs on drier ridges with sandier soils and southern slopes. In certain areas, oak-pine communities are formed by either species of oak along with yellow pine (*Pinus echinata).* White oak (*Q. alba*) is common on northerly slopes. Other common species are hickories (*Carya* spp.) winged elm (*Ulmus alata*), and persimmon (*Diospyros virginiana*). Black oak (*Q. velutina*) enters forest communities and may replace pines during succession, leading to an oak-hickory community (Braun 1950).

Common understory species in upland oak-pine communities include dogwood (*Cornus florida*), *Vaccinium* spp., New Jersey tea (*Ceanothus americanus*) and fragrant sumac (*Rhus aromatica*). The herbaceous layer is composed mainly of oat grass (*Danthonia spicata*), St. Andrews cross (*Ascyrum hypericoides*), bird-foot violet (*Viola pedata*), mountain mint (*Pycnanthemum flexuosum*), stone-mint (*Cunila origanoides*), wild aster (*Aster patens, Aster linariifolius*), and legume species (Braun 1950).

In slope forests, dominant canopy trees often are white and black oaks. Red oak (*Q. rubra*) is common in mesic conditions, whereas dogwood is common in drier situations. Common understory trees and shrubs include redbud (*Cercis canadensis*), hornbeam (*Ostrya virginiana*), iron wood (*Carpinus caroliniana*), red mulberry (*Morus rubra*), serviceberry (*Amelanchier arborea*), paw-paw (*Asimina triloba*) and southern buckthorn (*Bumelia lanuginosa*). Summer flora is less varied in slope forests than in uplands. Common shrubs in the area include hydrangea (*Hydrangea arborescens*), Virginia creeper (*Parthenocissus quinquefolia*), black raspberry (*Rubus occidentalis*), green-briar (*Smilax hispida*), and spice bush (*Lindera benzoin*). The herbaceous layer generally is open and includes false Solomon's seal (*Smilacina racemosa*), bellwort (*Uvularia grandifolia*), wild geranium (*Geranium maculatum*), stonecrop (*Sedum ternatum*), passion flower (*Passiflora lutea*), wild comfrey (*Cynoglossum virginianum*), goldenrod (*Solidago caesia*) and white snakeroot (*Eupatorium rugosum*) (Braun 1950).

In mesic slope forests, red oak (*Q. rubra*) and sugar maple (*Acer saccahrum*) are dominant canopy species. They are particularly abundant in limestone forests along with other trees such as white oak, chinquapin oak (*Q. muhlenbergii*), basswood (*Tilia americana*), and bitternut hickory (*C. cordiformis*). The undergrowth on mesic slopes is dense, resembling that of the eastern mesophytic forests more than oak forests of this region. Most shrubs and herbs on mesic slopes are common and widespread species (Braun 1950).

Lowlands of the Salem Plateau, except for alluvial lands of larger rivers, support stages of succession leading to establishment of maple-hickory forests. Common species in lowlands are silver maple (*A. saccahrinum*), sycamore (*Platanus occidentalis*), black willow (*Salix nigra*), cottonwood (*Populus deltoides*), white elm (*U. americana*), river birch (*Betula nigra*), and green ash (*Fraxinus pennsylvanica*). Sweet gum is abundant and associated with white and winged elm, walnut (*Juglans* spp.), river birch (*Betula nigra*), and sycamore (Braun 1950).

Cliffs, rocky limestone slopes, and balds support xerophytic communities. Red cedar (*Juniperius virginiana*) is the dominant tree in xerophytic communities. Glades occur on southerly facing slopes and are characterized by their xerophytic flora. Glades may be treeless, although there are usually scattered red cedars, redbuds, oaks, and dogwoods. Open glades are rapidly encroached upon by pioneer forest communities (Braun 1950).

Most land on Fort Leonard Wood is forested. The oak-hickory forest association is predominant. On bottomlands, the sycamore-elm-soft maple association is common (HBA 1995). North facing slopes are usually vegetated with black, red, and white oak, while southern slopes are dominated by post oak, blackjack oak, and hickories. The shrub layer and herbaceous layer are rich with both woody and herbaceous plants (Braun 1950).

On Fort Leonard Wood, unforested land not used for military training is covered with annual grasses, herbaceous plants, patches of broom sedge (*Andropogon virginicus*), sumac (*Rhus* spp.), coralberry (*Symphoricarpos occidentalis*), persimmon, and sassafras (*Sassafras albidum*). Kentucky bluegrass (*Poa pretensis*) is also common in some areas.

4.1.6.2 Wildlife

Many species of wildlife occur on Fort Leonard Wood. See Volume III, Appendix F of Draft Environmental Impact Statement (HBA 1996) for a complete list of all species identified or known to occur on Fort Leonard Wood. Mammals known to inhabit the installation include white-tailed deer *(Odocoileus virginianus)*, beaver *(Castor canadensis)*, muskrat *(Ondatra zibethicus)*, mink (*Mustella vison*), raccoon *(Procyon lotor)*, opossum *(Didelphus virginiana)*, skunk *(Mephitis mephitis)*, red fox *(Vulpes fulva)*, gray fox (*Urocyon cinereoargenteus*), gray squirrel (*Sciurus carolinensis)*, and cottontail rabbit (*Sylvilagus floridanus*). Species of game birds observed on the installation include northern bobwhite *(Colinus virginianus)* and wild turkey *(Meleagris gallapavo)*. Fort Leonard Wood is the temporary home for migrating birds throughout the year (HBA 1995).

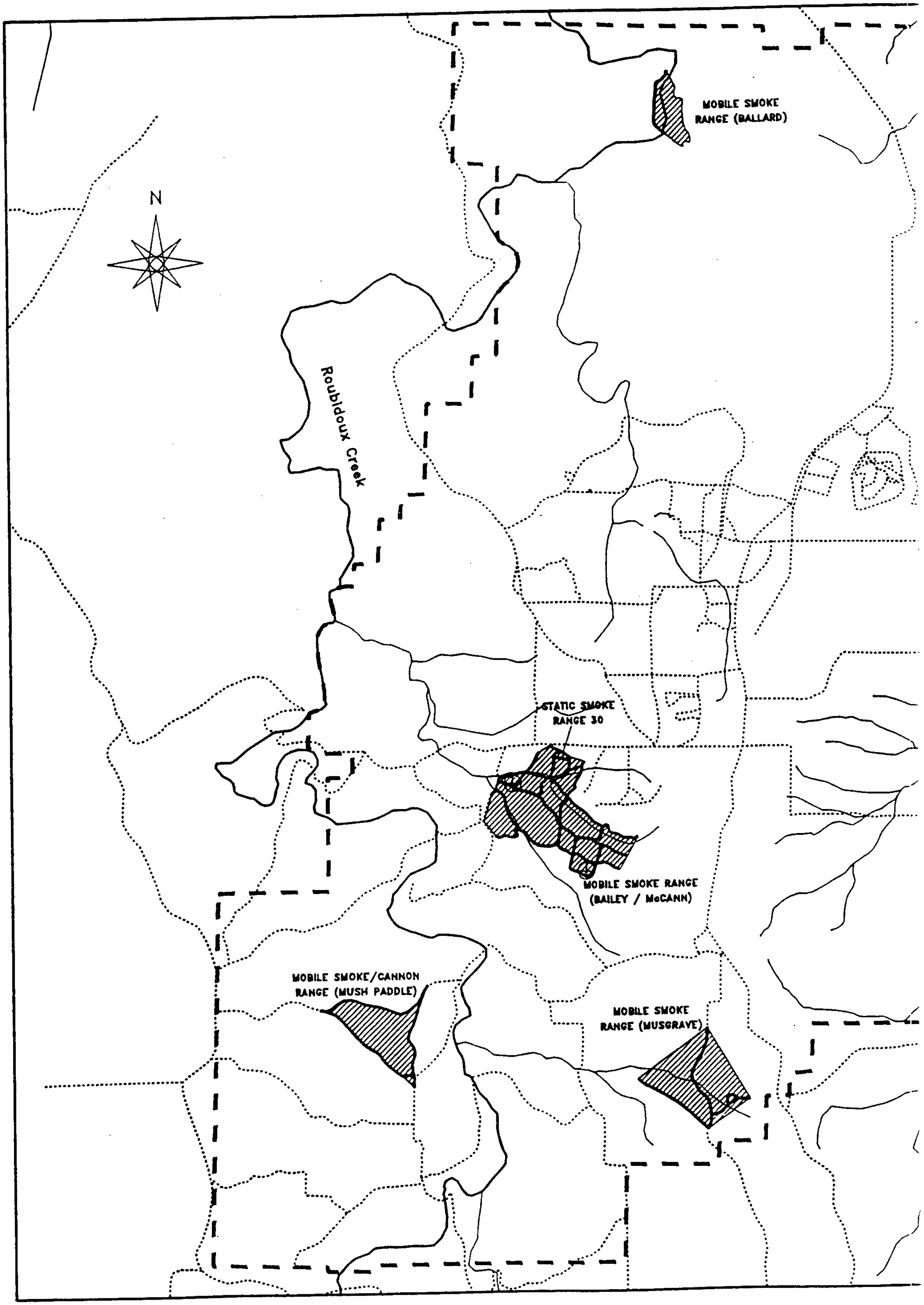
4.2 FOG OIL MOBILE AND STATIC SMOKE TRAINING AREA DESCRIPTIONS

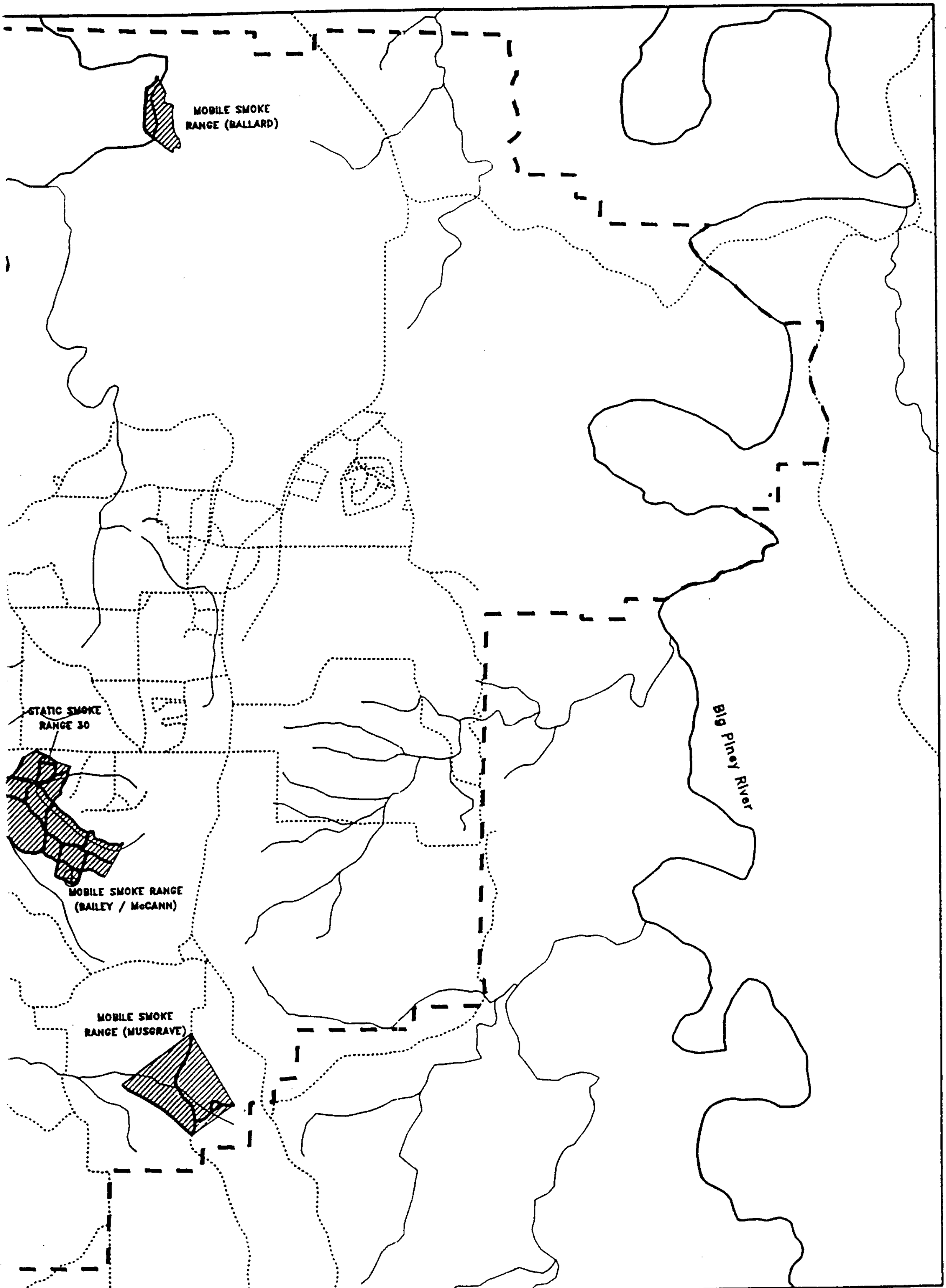
We investigated 4 mobile fog oil training areas, designated in the Fort Leonard Wood Air Permit Application - Project/Facility No. 3860-0004-015 Issued by State of Missouri Department of Natural Resources (April 1995). The four sites occur in Musgrave Hollow, Ballard Hollow, Cannon Range (Mush Paddle Hollow), and Bailey/McCann Hollow (Figure 5). Static smoke training is proposed only at Range 30F in Bailey/McCann Hollow.

4.2.1 Musgrave Hollow

Musgrave Hollow is near the southern edge of the installation, east of Cannon Range. Musgrave Hollow contains highly fragmented forest patches. Prescribed and accidental burning keep forests in most of this area in an early successional stage.

The stream in Musgrave Hollow is fed by a spring that flows most of the year. In the driest seasons, the stream averages 7.5 m wide. Upland areas are dominated by oaks averaging 20 cm dbh. Soil types in the hollow are Cedargap cherty silt loam in the riparian zone, Claiborne and Viraton silt loams on the pine plantations, and Poynor cherty silt loam on the uplands.


MOBILE SMOKE RANGE (BALLARD)
N
Roubidoux Creek
STATIC SMOKE RANGE 30
MOBILE SMOKE RANGE (BAILEY / McCANN)
MOBILE SMOKE/CANNON RANGE (MUSH PADDLE)
MOBILE SMOKE RANGE (MUSGRAVE)



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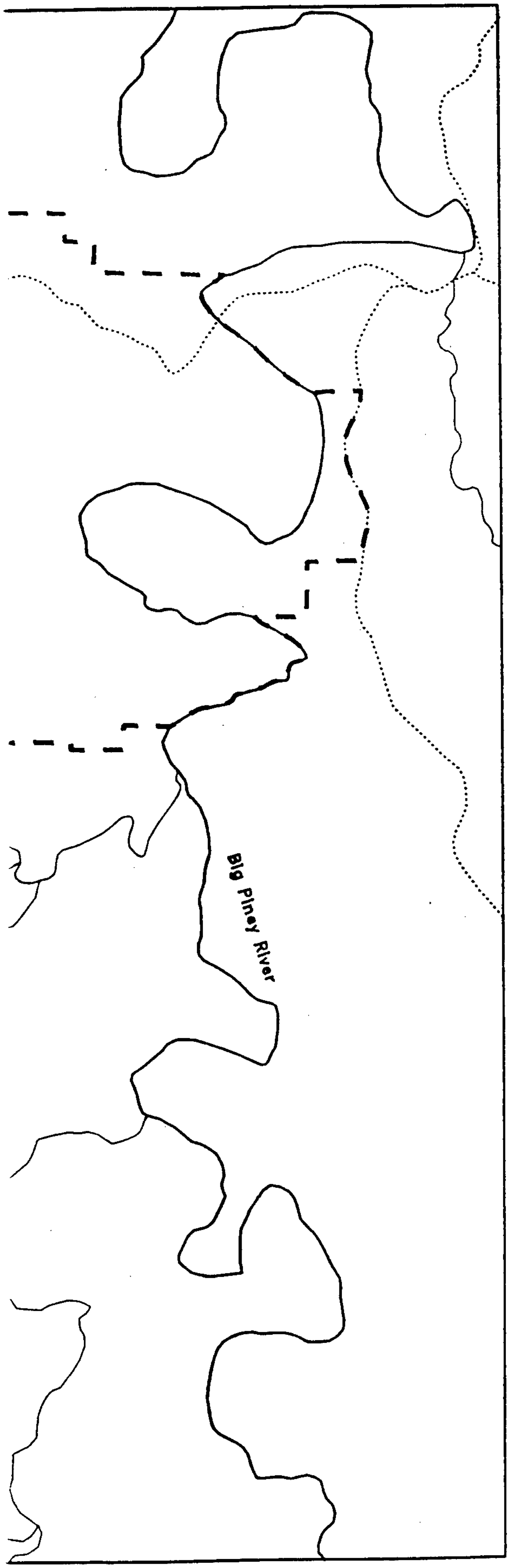
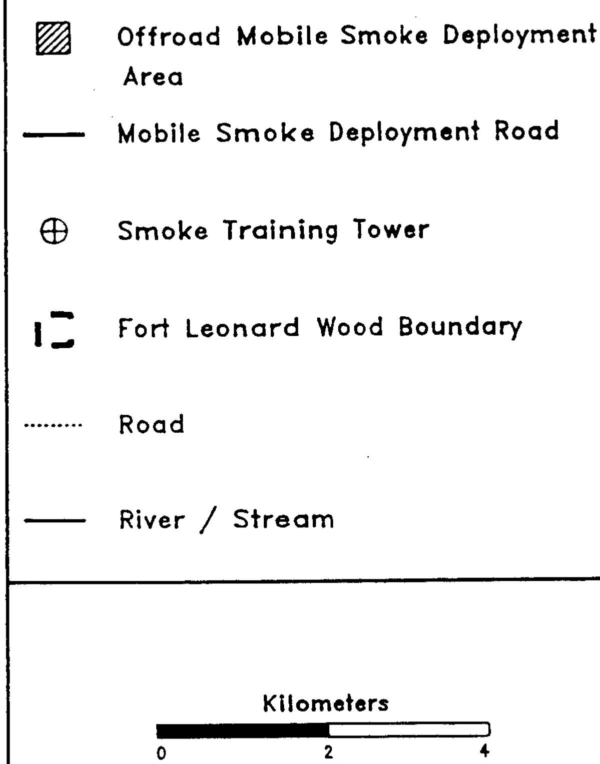


APPENDIX IV TO
BIOLOGICAL ASSESSMENT:
RELOCATION OF U.S. ARMY CHEMICAL SCHOOL AND MILITARY POLICE SCHOOL TO FORT LEONARD WOOD, MISSOURI

FIGURE 5. Proposed fog oil smoke training areas at Fort Leonard Wood, Missouri.



3D/ENVIRONMENTAL

4.2.2 Ballard Hollow

Ballard Hollow is near the northern border of Fort Leonard Wood, in the Roubidoux Creek valley, south of Cedar Hill Cemetery. West of Roubidoux Creek, topography in Ballard Hollow is dominated by steep, forested slopes. Unforested floodplain occurs east of Roubidoux Creek in Ballard Hollow.

Roubidoux Creek is ca. 25 m wide in Ballard Hollow and flows from south to north. The valley is dominated by sycamores averaging 35 cm dbh. Uplands west of Roubidoux Creek are dominated by oaks averaging 30 cm dbh. Some old field areas are south of the oak forest on the west side of the creek. Soil types include: Nolin silt loam in the riparian zone, Kickapoo fine sandy loam and Claiborne silt loam on slopes, and Clarksville-Gepp very cherty silt loams on uplands.

4.2.3 Cannon Range (Mush Paddle Hollow)

Mush Paddle Hollow is in the western portion of Cannon Range, in the southwest corner of Fort Leonard Wood. The stream in Cannon Range (Mush Paddle Hollow) flows seasonally. Soil types in Cannon Range (Mush Paddle Hollow) are Cedargap cherty silt loam in the riparian zone, Poynor and Clarksville-Gepp very cherty silt loams on the slopes, and Doniphan very cherty silt loam on upland areas of Cannon Range.

4.2.4 Bailey/McCann Hollows

Bailey/McCann Hollows are located southwest of Bloodland Lake and northeast of Cannon Range. Most of the area between Bailey and McCann hollows is to be used for training. Past and present training, prescribed and accidental burns, and firebreaks have cleared much of forest in this area.

Streams in Bailey/McCann hollows are ca. 6 m wide, and flow seasonally. Vegetation along the streams is uniformly small elms and maples. Stands dominated by oaks and hickories with trees averaging 20 cm dbh are scattered between the hollows. Soil types are Cedargap cherty silt loam in riparian zones, Clarksville very cherty silt loam and Gunlock silt loam on the slopes, and Ocie cherty silt loam on uplands.

4.2.5 Range 30F

Range 30F is within the Bailey Hollow area. The majority of the area is highly disturbed woodland, but there is a strip of mature forest 100 m wide along an intermittent stream. Soils types are Cedargap cherty silt loam in riparian zones, Clarksville very cherty silt loam, and Lebanon silt loam on the uplands.

4.3 TEREPHTHALIC ACID SMOKE POT AND TEREPHTHALIC ACID AND TITANIUM DIOXIDE TRAINING LOCATIONS

There are 22 grenade training locations on Fort Leonard Wood, where TPA and titanium dioxide grenades will be deployed: TA 148, 243,,238, 240N, 240S, 241, Range 33, 238B, 233, 237, 270, 271, 272, 273, Range 28, FP 6, Sapper TA, TA 126, 125, 194, 234, and grenade training road. There are 9 locations where smoke pots will be deployed on Fort Leonard Wood: Cannon Range (Mush Paddle), Bailey McCann, Mush Grave, and Ballard mobile smoke training areas, and FP 6, Range 28, Range 33, Ballard - In, and Ballard - Out.

In our assessment of effects of TPA grenades and smoke pots, we measured distances from mouths of Indiana bat hibernacula, gray bat caves, and Roubidoux Creek and Big Piney River to a central point within applicable training areas. Actual distances from caves and waterways to precise deployment sites may be less than distances displayed in Tables 26, 28, and 30.

Habitat in grenade and smoke pot training locations is variable. Most of the training locations are open field with little vegetation. Soil types and geomorphological features are described in Section 4.1.

4.4 BIDS AND FOX TRAINING SIMULANTS

BIDS and FOX training simulants will be used indoors or outdoors. Interior training will occur in the General Instruction Facility and exterior training will occur on existing training ranges. General description of the habitat of Fort Leonard Wood is presented in Section 4.1.

4.5 POLYETHYLENE GLYCOL (PEG 200)

PEG 200 will be used at Hasty Decontamination sites. See HBA (1996) for further descriptions of the habitat and site features of these locations.

Section 5
Stressor Characterization

Section V:

Stressor Characterization

5.1 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

We assessed obscurants, BIDS and FOX training simulants, and non-specific simulants for the ERA. We developed a list of COPC (Chemicals of Potential Concern) from the comprehensive list of chemicals, munitions, equipment, and materials listed in Attachment A (Table A-1). These items were provided by Fort McClellan's Military Police School and Chemical School, and represent chemicals expected to be used at Fort Leonard Wood. Fog oil and terephthalic acid were both evaluated as smoke/obscurants. We addressed effects from all identified simulants expected to be used at Fort Leonard Wood (Table 6).

5.2 CHEMICAL PROPERTIES AND DESCRIPTIONS

5.2.1 Fog Oil

Fog oil, SGF2, types D and E, are composed of alkanes, alkenes, and alkynes (hydrocarbons C_2 to C_{50}).

5.2.1.1 General Description

Fog oil is a middle distillate product of crude petroleum oil. Crude petroleum oil has different components depending on its source. There is no exact formulation or specific

TABLE 6. Chemical stressors evaluated for the ecological risk assessment.

Chemical Stressor	Training Use
Fog Oil - (SGF2), M56 (XM), M157 = Generators	Smoke Training
Terephthalic acid (TPA)	
TPA Grenades M83 (XM40), TA M93	Smoke Training
TPA Smoke Pots - floating M8TA, XM8 or XH11	Smoke Training
BIDS & FOX Simulants	
Bacillus subtillus	BIDS
Male specific coliphage	BIDS
Erwinia herbicola	BIDS
Ovalbumin	BIDS
Kaolin Dust	BIDS
Anisole	FOX
Benzaldehyde	FOX
Cyclohexane	FOX
DEM - Diethyl malonate	FOX
Diethyl phthalate	FOX
Dimethyl phthalate	FOX
Ethyl phthalate	FOX
Eucalyptol	FOX
MES - Methyl Salicylate	FOX
Soman (GD)	FOX (PCAS)
Sodium carbonate	
polyethylene oxide	
hydroxyethyl cellulose	
glycerol	
diethyl malonate (DEM)	
Mustard Lewisite	FOX (PCAS)
ferrous ammonium sulfate	
polyethylene oxide	
hydroxyethyl cellulose	
glycerol	
methyl salicylate	
CADS (Chemical Agent Disclosure Solution)	FOX (PCAS)
2,2 Dipyridyl	
phenophthalein	
isopropanol	
Non-specific simulants	
PEG 200 (mixed butyl mercaptan)	chemical warfare training
Titanium dioxide (M82 grenades)	obscurant training

chemical composition for petroleum products like fog oil. The first distillation volatilizes gases, naptha, gasoline, and middle distillate fractions. The remaining material ranges in molecular size from C_2 to C_{50}. A further refining of the middle distillate transforms the pale oils to white oils. The petroleum distillate the military calls fog oil is also used as a diesel engine lubricating oil (Lushbaugh et al. 1950). Industrial uses include: metal working, cutting oils, newspaper ink, agricultural pesticides, livestock spray, and medicinal uses such as laxatives.

Fog oil can be described as a mineral oil, petroleum distillate, hydrotreated heavy napthenic base oil. Chromatographic analysis of SGF 2 fog oil indicated aliphatic, alkane, and alkene hydrocarbons were present. No aromatic hydrocarbons were detected in a sample of liquid fog oil (type C or D) analyzed in August 1995 (3D/Environmental 1996a). Earlier analysis of old fog oil samples indicated 50% aliphatic and 50% aromatic compounds (Ballou 1981). Bausum and Taylor (1986) reported the following for old fog oil:

- total paraffins and aromatics often are present in equal amounts
- thousands of chemical species are present
- aliphatic compounds include normal branched alkanes, cycloparaffins, and olefins
- aromatic hydrocarbons range from one-ring compounds to those with four or more rings
- alkyl aromatic hydrocarbons may be present
- small amounts of polar organic substances (acids, esters, and alcohols) are in fog oil
- organic nitrogen and sulfur compounds and heavy metals may be present.

Fog oils and other petroleum products are used to produce white smokes. The military has used standard grade fuels (SGF 1 and SGF 2), diesel fuel, jet fuel JP4, and kerosene to produce smoke. SGF 1 has not been supplied to the military since the 1970s (Liss-Suter and Villaume 1978). SGF 2 fog oil has been used by the military since 1956, specification MIL-F-12070A or NATO Code No. F-62. A few years prior to the issue of MIL-F-12070C, fog oil was designated as "new" because the refining process was modified to reduce aromatic hydrocarbons which are potentially harmful (carcinogenic) (Driver et al. 1992). Fort McClellan uses fog oil Type D and Fort Leonard Wood will use fog oil type D or E depending on the military specifications provided to fog oil manufacturers at the time. Fog oil types C, D, and E do not and will not contain aromatic hydrocarbons. The physical and chemical properties of types C, D, and E fog oils are the same. They differ in manufacturer testing requirements. Fog oil type D must pass a mutagenicity test before it can be sold to the military. Fog oil type

E will have an added carcinogenicity test requirement. Physical properties were reported in the Military Specification Number MIL-F-12070D, Amendment 1, April 29, 1993 (Table 7).

5.2.1.2 Formation and Dispersion of Fog Oil Smoke

Fog oil was used by the military to conceal troops, beach landings, and supply lines during World War II and the Korean War. Oil burners were used to produce smoke initially, but the military now uses diesel or gasoline powered smoke generators. Smoke may be produced from mobile armored personnel carriers (mobile smoke), or from stationary locations (static smoke).

One of the first smoke generators used by the Army, and the generator used by Fort McClellan, was the M^3A3, a gasoline-driven pulse jet generator. The M^3A3 has been replaced by more efficient M^3A4, M56, and M157A2 generators. The M^3A4 generator uses gasoline (military mogas) as a fuel. The maximum fog oil consumption rate for the M^3A4 generator as reported in the Technical Manual is 50 gph (U.S. Army Technical Manual, TM 3-10040-276-10).

Mobile units proposed for use at Fort Leonard Wood (M56 and M157) that produce fog oil smoke burn up to 63 gph of diesel fuel. The M56 is a turbine based multispectral smoke generator. The M157A2 is mechanized pulse jet generator. Both the M56 and M157 have a fog oil consumption rate between 60 to 80 gph.

The M56 was developed for highly mobile, large-area and visual obscuration. It is a turbine based smoke generator mounted on a M1097 High Mobility Multipurpose Wheeled Vehicle (HMMWV). The turbine engine produces exhaust gas for vaporizing fog oil to provide

TABLE 7. Physical properties of fog oil.

Property	Value
Flash point, minimum	160°C
Saybolt universal viscosity	37.78°C (min) to 43.3°C (max)
Pour point	- 40°C
Density	0.92 g/cm^3
Maximum carbon residue	0.1 %
Maximum neutralization number	0.1

visual smoke. The M56 can make smoke for 90 minutes by pumping fog oil from two 45-gallon fog oil tanks to the turbine exhaust gas. This system entered production in 1995.

The M157 produces large-area visual smoke screens. The M157 smoke generator system is mounted on a HMMWV (mobile smoke) or track vehicle (mobile smoke). It consists of two pulse jet engine smoke generators, a control panel, an air compressor and accumulator, an electric fog oil pump, and an external fuel supply. Each smoke generator on the vehicle uses a jet engine to vaporize fog oil.

Fog oil is subjected to high temperatures during smoke generation: 540°C for the M^3A4 generator. The fog oil is not ignited inside the generator but some thermal decomposition and chemical interaction with exhaust gases can occur. Industrial Oils Unlimited, a military fog oil manufacturer, reported on a 1989 fog oil Material Safety Data Sheet that thermal decomposition products of fog oil are CO, CO_2, and oxides of sulfur. Volatile compounds, primarily alkanes up to C_{11} remain in the vapor state during the life of the fog. In a study of old fog oil, Bausum and Taylor (1986) reported there may be an increase in the aromatic component of fog oil that occurs during smoke production. No aromatic hydrocarbons were detected (MDL Method Detection Limit = 5 mg/L) in post-generator fog oil samples generated by M157 and M56 generators (3D/Environmental 1996a).

The diameter of fog oil aerosol droplets ranges from 0.5 µm to 1.2 µm (Liss-Suter and Villaume 1978). Fog oil droplets tend to agglomerate, which increases the rate of settling or deposition. Liss-Suter and Villaume (1978) reported fog oil droplets remain in the air an average of one hour. Settling rate varies with meteorological conditions. Fog oil droplets may be called particulate matter, and are considered aerosols based on their size. Particle size distribution of fog oil droplets is dependent upon generation method and concentration. Higher concentrations of fog oil in the atmosphere cause faster agglomeration of droplets.

Dispersion of liquid, recondensed fog oil is dependent upon meteorological conditions, site geography, mode of generation, and land surface structure. Deposited fog oil tends to be adhesive and is unlikely to be resuspended. Deposited fog oil evaporates within 24 hours after deposition (Mike Farmer, December, 1996, pers. comm.).

5.2.1.3 Fog Oil Deposition and Evaporation

Fog oil aerosols are recondensed fog oil vapor. When fog oil is passed through a generator, it is atomized or aerosolized. Fog oil smoke is a result of the hot vaporized oil recondensing after it is released into the atmosphere. Airborne fog oil aerosols deposit onto soil, water, vegetation, and other surfaces in the dispersion pathway. Fog oil deposits downwind and generally close to the source. Fog oil deposition rates range from 50 to 1300 mg/m^2 at 1 km from the source (Driver et al. 1992). Worst-case estimates of fog oil deposition have been reported at <10 mg/m^2 at distances greater than 2 km (Driver et al. 1992). Fog oil may undergo weathering, evaporation, and emulsification, before and after deposition. Chemical processes that may transform fog oil include photo-oxidation and polymerization. In addition to physical and chemical reactions, fog oil is biodegradable.

Some fog oil particles evaporate immediately. The mass of fog oil droplets decrease with time, and the rate of decrease is a function of temperature. Driver et al. (1992) estimated the rate of evaporation for 90% of aerosol fog oil ranges from 15 days to 150 days as temperature decreases from +40°C to -40°C. These times probably exceed actual residence time of fog oil in the environment because other physical and chemical processes (weathering, photo-oxidation, etc.) simultaneously degrade fog oil. If the evaporation rate of fog oil is not used to predict surface deposition, fog oil deposition may be overestimated by 50% to 70% (Driver et al. 1992).

5.2.1.4 Physical Processes

Exposure to the environment causes weathering. The weathering process occurs more rapidly when a compound is in the vaporized state (Driver et al. 1992). Fog oil compounds do not remain in the atmosphere long enough to attribute mass loss to weathering processes.

Emulsification may occur when fog oil is deposited onto surface water. A fog oil film may form on the surface of the water and undergo emulsification, biotransformation, biodegradation, and evaporation.

5.2.1.5 Predicted Fog Oil Use

Fog oil use is proposed in 5 smoke training areas at Fort Leonard Wood: Musgrave Hollow, Ballard Hollow, Cannon Range (Mush Paddle Hollow), Bailey/McCann Hollow (mobile), and Range 30F (static) (Figure 5). Burns and McDonnell (1993) modeled dispersion of fog oil under Pasquill categories A - F from mobile smoke training areas. The data was used by the Missouri Department of Natural Resources, Division of Environmental Quality, for the Air Permit Application for static and mobile fog oil training at Fort Leonard Wood. The permit specifies daily and yearly limitations of fog oil use. Since the permit was issued, the proposed amount (both daily and yearly) of fog oil use has changed to reflect an increase in number of military personnel to be trained at Fort Leonard Wood.

We assessed risks to Indiana bats, gray bats, and bald eagles from implementation of one of the 4 training alternatives proposed in the preliminary draft Environmental Impact Statement (HBA 1996). The three action alternatives, Relocate Current Practice (RCP), Environmentally Preferred Training Method (EPTM), and Optimum Training Method Alternative (OPTM) differ in the amount of fog oil to be used in Training Activities 7.2 (static smoke), 7.3 (mobile smoke operations), and 7.4 (mobile field training). Fog oil use is not proposed in the No Action Alternative (Table 8). We analyzed effects based on the quantity specified in the for Optimum Training Method Alternative (OPTM) static and mobile fog oil training.

Our analysis assumes daily maximum use of 1200 gallons of fog oil in static and/or mobile training, with a source rate of 0.66 gallons per minute. The yearly maximum quantity varies for each static and mobile smoke training alternative. We used a maximum of 20 generators for static training and 12 generators for mobile training.

5.2.1.6 Environmental Fate of Fog Oil

3D/Environmental (1996a) conducted an environmental fate study of fog oil at Fort McClellan, Alabama. No increase of fog oil hydrocarbons were noted in soil, surface water, sediment, tree bark, leaf, insect, or bat tissue samples taken from high use (fog oil exposure sites. Fog oil is readily biodegradable and will remain in soil only a few days, depending on soil fauna present and time of year the fog oil is released. No studies have been produced that indicate new fog oil will bioaccumulate in soil or other media.

TABLE 8. Static and mobile fog oil training alternatives, associated quantities of fog oil, and proposed number of fog oil generators (Darrel Sisk, April 17, 1996 pers. comm.). Only the OPTM is assessed in this ERA.

	Training Activities		
Alternative	7.2 Static Smoke	7.3 Mobile Operations	7.4 Mobile Field Training
No Action	0 generators 0 gal/yr.	0 generators 0 gal/yr.	0 generators 0 gal/yr.
Relocate Current Practice (RCP)	20 generators 20,000 gal/yr.	12 generators 41,500 gal/yr.	12 generators 64,000 gal/yr.
Optimum Training Method (OPTM)	20 generators 8500 gal/yr.	12 generators 20,000 gal/yr.	12 generators 56,000 gal/yr.
Environmentally Preferred Training Method (EPTM)	1 generator 1000 gal/yr.	12 generators 20,000 gal/yr.	12 generators 28,500 gal/yr.

Harmful quantities of fog oil are not expected to occur in the environment at Fort Leonard Wood because it is readily biodegraded by aerobic microorganisms. Large quantities of fog will not reach caves, groundwater, or other water systems via soil erosion, deposition, or storm water runoff. When fog oil enters water, it is attenuated rapidly due to its water solubility. Fog oil is also biodegraded by microorganisms and can undergo chemical degradation in aqueous environments. We do not anticipate any accumulation of fog oil or its components in the soil, groundwater, or surface water at Fort Leonard Wood. It should not cause any indirect effects to Indiana bats, gray bats, or bald eagles by reducing or affecting their prey.

5.2.2 Terephthalic Acid (TPA)

5.2.2.1 Chemical Structure

$C_6H_4(COOH)_2$

5.2.2.2 General Description

TPA is usually found as white crystals or powder. It is insoluble in water, ether, acetic acid and is slightly soluble in alcohol. TPA is soluble in alkalis. TPA is commonly used as a reagent for alkali in wool and as an additive to poultry feed. TPA has a relatively low toxicity (Hawley 1977).

5.2.2.3 Environmental Fate

TPA can enter the environment during the in manufacture of polyester fibers, films, and bottles. Wastewater samples from a polyester fiber industry were found to contain TPA. The origin of TPA in polluted rivers in Japan was attributed to anthropogenic sources. Most TPA in air particulate matter in a relatively unpolluted mountainous region of Japan was produced by the photochemical oxidation of anthropogenic compounds during long-range transport.

A biodegradation test with soil suspension suggests TPA may readily biodegrade in soil. TPA may biodegrade slowly in subsurface soil. The estimated K_{oc} value of 292 for undissociated TPA indicates that it would have moderate mobility in soil (HSDB 1987).

In screening tests, TPA was found to biodegrade in water, particularly when the microorganisms in aquatic media are adapted to the compound. No quantitative data are available for the rate of biodegradation of TPA in natural water. The loss of TPA from water due to photolysis, hydrolysis and oxidation by hydroxyl radicals does not appear to be important. The estimated K_{oc} of 292 suggests some undissociated TPA may be removed from water by absorption onto suspended solids and sediment (HSDB 1987). The estimated bioconcentration factor (BCF) of 19 indicates bioconcentration of TPA by aquatic organisms should not be significant. EPA (1989) suggests, bioconcentration factors > 300 are of a concern to biota.

TPA has been selected to replace the more toxic and hazardous hexachloroethane. TPA has been shown to be degraded by soil and aqueous microorganisms.

5.2.2.4 Environmental Transformation

Phthalate esters undergo primary and ultimate biodegradation in naturally occurring microbial systems which may include some form of enzymatic hydrolysis. The rate of

degradation can depend upon temperature, pH, presence of oxygen, phthalate structure, and other variables.

A strain of *Mycobacterium lacticolum* that can degrade TPA was isolated from industrial sewage containing terephthalate. In tests conducted under aerobic conditions with activated sludge as inoculum, TPA at an initial concentration of 100 mg/L was found to be biodegradable. Adaptation of microorganisms accelerates the biodegradation of TPA. At the end of 24 days of acclimation of activated sludge, 96% of TPA at an initial concentration of 1000 mg/L of COD biodegraded in 4 hours. TPA was determined to be biodegradable under other biodegradation screening test conditions. Complete loss of TPA occurred in 2 days from a soil suspension inoculum containing 20 ppm of the compound. Limited anaerobic biodegradation of TPA appeared to have occurred when industrial waste containing the compound was injected in a subsurface aquifer.

Because phthalate esters do not possess significant absorption maxima in the terrestrial sunlight region of the electromagnetic spectrum, they are unlikely to undergo direct photochemical reactions in surface waters. TPA does not contain hydrolyzable functional groups. Therefore, hydrolysis of TPA should not be important. Direct photolysis of TPA in the environment has been assessed to be unimportant (HSDB 1987). The rate constant for the vapor-phase reaction of TPA with photochemically produced hydroxyl radicals has been estimated to be 2.75×10^{-13} cu cm/molecule-sec. This rate constant corresponds to a half-life of 58 days at a daily average atmospheric hydroxyl radical concentration of $5 \times 10^{+5}$. The rate constant for the reaction of photochemically produced OH^{-} radicals with TPA in water at pH 9 has been estimated to be $3.2 \times 10^{+9}$ L/mole-sec. Based on a hydroxyl radical concentration of $3 \times 10\text{-}^{17}$ mole/L in natural eutrophic waters, this reaction will not take place in water.

5.2.2.5 Environmental Transport

Bioconcentration

The bioconcentration factor (BCF) for undissociated TPA in aquatic organisms can be estimated at 19, based on $\log_{10} K_{ow}$ of 2. Therefore, bioconcentration of undissociated TPA in aquatic organisms may take place, but EPA (1989) reports BCFs greater than 300 are considered significant.

Soil Absorption/Mobility

The dissociation constants pK1 and pK2 for TPA at 25°C are 3.54 and 4.46, respectively. In most natural waters and soils where the pH is close to neutral, TPA will exist predominantly in the ionic form. Ionic compounds may be absorbed to soil, and suspended solids and sediment in water by ion exchange or absorption at mineral surfaces. However, the mechanism of absorption of undissociated TPA is expected to be similar to covalent organic compounds. The estimated K_{oc} value indicates that undissociated TPA will show medium mobility in soil.

Volatilization from Water/Soil

The dissociation constants pK1 and pK2 for TPA at 25°C are 3.54 and 4.46, respectively. In most natural waters where the pH is close to neutral, TPA will exist predominantly in the ionic forms. Ionic compounds are not known to volatilize from water. However, the undissociated portion of TPA may volatilize from water.

5.2.2.6 Environmental Concentrations

Water Concentrations

TPA was detected in concentrations of 1.1 ppb to 3.4 ppb in polluted river water, but none was detected in unpolluted waters (HSDB 1987).

Atmospheric Concentrations

TPA was qualitatively detected in the gas phase of urban air from Belgium. It was also qualitatively detected in the air particulate matter collected from Tokyo, Japan. TPA was detected in atmospheric aerosol and in rainwater particle extracts from West Los Angeles, CA. (HSDB 1987).

The average concentrations of TPA in airborne aerosols from two relatively unpolluted mountainous regions of Japan were 11.1 ng/m^3 and 3.9 ng/ m^3 (HSDB 1987).

5.2.3 BIDS Simulants

5.2.3.1 Bacillus Subtilis

Physical Structure

Rod shaped microorganism

General Description

Bacillus subtillus is aerobic and very common in soil. Though it may occasionally cause infections of the eye, lung, and soft tissues, *B. subtilis* is generally harmless to man (Fuerst 1983, Sherris and Ryan 1984). In the laboratory, *B. subtilis* produces the antibiotic bacitracin (Fuerst 1983). *B. subtilis* forms endospores that can endure adverse conditions and some disinfectants. However, it can be destroyed by heating 10 - 15 min at 100°C in moist heat or 1 hour at 150°C in dry heat (Pelczar and Reid 1965). *B subtilis* is used as a pesticide applied to seeds of soybeans. It colonizes the root system of the plant and competes with disease-causing organisms (EPA 1992b).

B. subtillus is also used in laundry detergents. It can be a severe eye irritant and is poisonous via intraperitoneal exposure. When heated to decomposition, it produces noxious ammonia-like fumes (Lewis 1992).

Environmental Fate

B. subtillus is found virtually everywhere. Data for environmental fate were not included because the organism is a naturally occurring species. *Bacillus* is not expected to be pathogenic or toxic to aquatic organisms, wild mammals, or non-target insects including honey bees (EPA 1992b).

5.2.3.2 Male Specific Coliphage (MS2)

Physical Structure

Polyhedral shaped virus

General Description

Coliphage is a virus that attacks the bacteria *Escherichia coli*. It is <1μ in diameter and has a tail-like appendage that allows attachment to the host (Pelczar and Reid 1965). Male Specific Coliphage (MS2) is relatively resistant to disinfectant, although it is inactivated by monochloramine (Berman et al. 1992). Coliphage behaves similarly to polio viruses (Maillard et al. 1994).

Environmental Fate

Male Specific Coliphage is found regularly in the natural environment as well as in waste water treatment plants (University of Louisville, Life Sciences Division Environmental Data Base 1996).

5.2.3.3 Erwinea herbicola

Physical Structure

Rod shaped bacteria

General Description

The genus *Erwinea* belongs to the family Enterobacteriaceae. *Erwinea* are gram-negative, motile rods. Some species of *Erwinea* are plant pathogens (Pelczar and Reid 1965), however *Erwinia herbicola* is described as a non-pathogenic bacteria which reduces the incidence of fire blight in fruit trees. Under normal circumstances the bacteria is non-harmful to plants or animals, however eye irritation may occur (EPA 1992b). *E. herbicola* occurs naturally in the environment as a soil epiphytic bacterium.

Environmental Fate

Because the organism is considered harmless, no literature was found on the environmental effects of released *E. herbicola* or the fate of *E. herbicola* in the environment.

5.2.3.4 Ovalbumin

Chemical Structure

Single polypeptide chain of about 400 residues, phosphate residues, and a side chain of manose and glucosamine.

General Description

The major protein component of chicken egg white, ovalbumin makes up 75% of the egg albumin.

Environmental Fate

Because ovalbumin is a naturally occurring protein, no literature was found on the environmental effects of released ovalbumin or it's fate in the environment.

5.2.3.5 Kaolin Dust

Chemical Structure

$H_2Al_2Si_2O_8 \bullet H20$ (approximately)

General Description

Kaolin, the purest form of clay, is formed naturally from decomposition of feldspar minerals. It is a hydrated aluminum silicate that is non-toxic and non-combustible. Kaolin is a stable, off-white or yellow powder (Sigma Chemical Co. 1994b, Lewis 1992). It is insoluble in ether, alcohol, alkali solutions, and dilute acids.

Kaolin related clays occur in several types of deposits. Many kaolin deposits throughout the world are tabular lenses and discontinuous beds in sedimentary rock. Extensive sedimentary deposits of this type occur in the Georgia-South Carolina kaolin belt, Arkansas bauxite region, and one district in California.

Environmental Fate

No information available.

5.2.4 FOX Simulants

5.2.4.1 Anisole

Chemical Structure

C_7H_8O

General Description

Synonym for methoxybenzene. Anisole, a phenol, is a clear, straw color liquid with an anise-like odor. It is insoluble in water, soluble in alcohol and ether, and is flammable. Anisole is used as a solvent, vermicide, and chemical intermediate. It also is used in perfume and flavoring industries (Hawley 1977). Anisole was identified as a compound isolated from essential oil of *Ocumum selloi*.

Environmental Fate

No information available.

5.2.4.2 Benzaldehyde

Chemical Structure

C_7H_6O

General Description

Benzaldehyde, an aromatic compound, is a colorless liquid with bitter almond odor (HMIS 1994). It is volatile and combustible (Hawley 1977). Benzaldehyde is slightly soluble in water, and miscible in ether and alcohol (Lewis 1992). The compound is a natural chemical found in plants and animals. As artificial almond oil, benzaldehyde is used in food, beverage, pharmaceutical, perfume, soap, and dye industries (Lewis 1994, USDHHS 1994b). Benzaldehyde is released to the environment in emissions from combustion of gasoline and diesel fuels.

Environmental Fate

If released to the atmosphere, benzaldehyde degrades by reaction with photochemically produced hydroxyl radicals; direct photolysis may contribute to its atmospheric degradation. Physical removal from air by wet deposition can occur. If released to soil or water, the major degradation pathway is expected to be biodegradation. Physical transport from water can occur through volatilization. Benzaldehyde will leach into the soil (HSDB 1987).

5.2.4.3 Cyclohexanone

Chemical Structure

$C_6H_{10}O$

General Description

Cyclohexanone is a flammable, colorless liquid with an acetone-like odor. It is soluble in water and miscible in most organic solvents (Miall and Sharp 1968). Uses include an intermediate in chemical synthesis, manufacture of artificial leather, plastics, and nylon, and formulation of solvents (Hawley 1977).

Environmental Fate

Cyclohexanone has high mobility in soil, and volatilizes from surface soils. It biodegrades in aerobic biodegradation screening tests and river die-away tests and therefore would be expected to biodegrade in soil. If released in water, cyclohexanone is slowly lost by volatilization. It's estimated half life in a model river and model lake is from 4.1 to 33 days. It would also be expected to biodegrade, but rates in natural water are unavailable. It is not expected to adsorb to sediment or particulate matter in the water column or bioconcentrate in aquatic organisms. In the atmosphere, cyclohexanone will degrade by reacting with photochemically-produced hydroxyl radicals. The general population is exposed to cyclohexanone from ambient air and possibly from contaminated drinking water (HSDB 1987).

5.2.4.4 Diethyl Malonate (DEM)

Chemical Structure

$CH_2(COOC_2H_5)_2$

General Description

DEM is an ester, and is otherwise known as ethyl malonate. DEM is a colorless liquid with a sweet ester odor. It is insoluble in water, but soluble in organic solvents. It is combustible when exposed to heat or flame and may react with oxidizing materials (Lewis 1992). DEM is used as a chemical intermediate for barbiturates and pigments, and is also in food flavoring (Hawley 1977).

Environmental Fate

DEM is likely to hydrolyze in soil or leach into groundwater (where is should completely hydrolyze). It will not volatilize significantly from soil. In water, DEM should hydrolyze but it will neither readily evaporate, adsorb to sediments or bioconcentrate in aquatic organisms. Oxidation of DEM by hydroxyl radicals may occur in water. No information on the biodegradation of DEM in water or soil was available.

5.2.4.5 Diethyl Phthalate (DEP)

Chemical Structure

$C_6H_4(CO_2C_2H_5)_2$

General Description

Also called ethyl phthalate, DEP is a stable, water-white, odorless, liquid with bitter taste. It is insoluble in water but soluble in organic solvents. It is combustible. DEP is useful as a plasticizer due to stability and low vapor pressure (Miall and Sharp 1968). It may also be used as a chemical solvent, wetting agent, insecticidal spray, and perfume fixative (Hawley 1977).

Environmental Fate

If released into the soil, DEP is expected to undergo aerobic biodegradation. Oxidation, chemical hydrolysis and volatilization from wet surfaces are not expected to be significant fate processes. DEP may volatilize from dry surfaces. If released into water, DEP is expected to biodegrade. Anaerobic biodegradation would be very slow or not occur at all. Volatilization should not be an important removal process in most bodies of water although it may be important in shallow rivers. Removal by oxidation, chemical hydrolysis, direct photolysis, indirect photolysis or bioaccumulation in aquatic organisms should not be significant. If released into the atmosphere, DEP is expected to exist in vapor form, and as adsorbed matter on airborne particulates. DEP vapor is expected to react with photochemically generated hydroxyl radicals. Physical removal by particulate settling and washout in precipitation will also occur (HSDB 1987).

5.2.4.6 Dimethyl phthalate (DMP)

Chemical Structure

$C_6H_4(COOH_3)_2$

General Description

Dimethyl phthalate is a colorless and odorless liquid that is insoluble in water. It is combustible when exposed to flame. It is used in formulations of plastics, insecticides, pesticides, fungicides, detergents, munitions, industrial oils and defoaming agents (Hawley 1977, Pierce et al. 1980).

Environmental Fate

The primary loss mechanism of DMP appears to be biodegradation. Half-lives of 8 - 11 days and 0.2 days have been found in river water, but no half-life is available for soil or groundwater. DMP is utilized by soil microorganisms and degrades under anaerobic conditions. Little adsorption to soil or sediment will occur. DMP will not bioconcentrate in fish. If DMP is emitted into the atmosphere, it will most likely be as an aerosol and it will be subject to rainout and gravitational settling. Photodegradation by hydroxyl radicals will also occur (HSDB 1987).

5.2.4.7 Ethyl Phthalate

Chemical Structure

$C_6H_4(CO_2CH_2CH_3)_2$

General Description

Ethyl phthalate has been used in industrial nations as a plasticizer, and in cosmetics, insect repellents and munitions. Ethyl phthalate is an odorless, clear, colorless, oily liquid with a bitter taste. It is soluble in alcohol, ether, benzene, and moderately soluble in aliphatic solvents (MSDS Fischer Scientific).

Environmental Fate

Like most other phthalate esters, ethyl phthalate is not readily volatilized from aquatic environments. It is also not hydrolyzed in aquatic environments. The chief degradation process is through enzymatic routes. Ethyl phthalate is readily degraded (fish 99% clearance in 24 hours). Ethyl phthalate will bioaccumulate under conditions of continuous exposure, however biomagnification is not expected to be significant (Pierce et al. 1980). In general, ethyl phthalate is not persistent in the environment (Woodward 1986).

5.2.4.8 Eucalyptol

Chemical Structure

$C_{10}H_{18}O$

General Description

A terpene ether, also called cineol and cajeputol. An essential oil produced by distilling oil from trees in the genus *Eucalyptus*. Each species of tree produces a different oil. Eucalyptol is colorless with camphor-like odor, slightly soluble in water, and miscible with organic solvents (Hawley 1977). Eucalyptol is used in pharmaceutical manufacturing and the flavoring and perfume industries.

Environmental Fate

No information available.

5.2.4.9 Methyl Salicylate (MES)

Chemical Structure

$C_8H_8O_3$

General Description

Methyl salicylate is a colorless, reddish, or yellowish, oily liquid ester with a wintergreen taste and odor. Methyl salicylate is only slightly soluble in water and is soluble in organic solvents (HMIS 1994, Lewis 1992). It occurs naturally in plants including wintergreen and birch and is found in cherry, apple, and raspberry juices (Opdyke 1979).

Environmental Fate

MES is likely to biodegrade in soil. In alkaline soil, chemical hydrolysis may contribute to its degradation. It may also undergo direct photolysis on the surface. MES is expected to be fairly mobile in soil. If released in water, MES should slowly volatilize, biodegrade, and be lost as a result of direct photolysis and photo-oxidation in surface waters. In alkaline water, hydrolysis may also be a significant fate process. MES is not likely to bioaccumulate in aquatic organisms. MES will react with photochemically-produce hydroxyl radicals in the atmosphere resulting in a estimated half-life of 1.4 days. It is relatively soluble in water and may be washed out by rain.

5.2.4.10 Sodium Carbonate (a Chemical Constituent of Soman, PCAS)

Chemical Structure

$CO_3 \cdot 2NA$

General Description

Sodium carbonate is a white, odorless, crystalline powder with an alkali taste. It is hygroscopic and soluble in water. Sodium carbonate is also known as carbonic acid.

Environmental Fate

No information on the environmental fate of sodium carbonate is available.

5.2.4.11 Polyethylene Oxide (a Chemical Constituent of Soman, PCAS)

Chemical Structure

$[C_2H_4O]_nH$

General Description

Polyethylene oxide is a colorless, flammable gas at ordinary room temperature and pressure, however it is in it's liquid form below 12 bars. Polyethylene oxide is soluble in water, alcohol, and ether.

Environmental Fate

No information available.

5.2.4.12 Hydroxyl Ethyl Cellulose (a Chemical Constituent of Soman, PCAS)

Chemical Structure

No information available.

General Description

Hydroxyethyl cellulose is a cellulose ether that is water soluble and non-ionic. Hydroxyethyl cellulose is used for thickening, stabilizing, and suspending other compounds (Hawley 1977). Ethyl cellulose is a odorless, white powder. It is commercially used in hot-melt adhesives, resins, oils, and plasticizers (Lewis 1992). It is soluble in most organic liquids and insoluble in water and glycerol (Lewis 1992).

Environmental Fate

Ethyl cellulose is not a risk to human or animal health (Scientific Polymer Products Inc. 1994). It is not toxic or carcinogenic.

5.2.4.13 Glycerol (a Chemical Constituent of Soman, PCAS)

Chemical Structure

$C_3H_5(OH)_3$

General Description

A trihydric alcohol, glycerol is a colorless, odorless, hygroscopic liquid. It is miscible with water and alcohol (Hawley 1977, Miall and Sharp 1968). Uses include explosives, soaps, lubricants, gums, and plastics.

Environmental Fate

No information available.

5.2.4.14 Diethyl Malonate (DEM) (a Chemical Constituent of Soman, PCAS)

Information on DEM can be found in Section 5.2.4.4.

5.2.4.15 Ferrous Ammonium Sulfate (a Chemical Constituent of Mustard Lewisite, PCAS)

No information on ferrous ammonium sulfate was available.

5.2.4.16 Polyethylene Oxide (a Chemical Constituent of Mustard Lewisite, PCAS)

Information regarding this chemical is provided in Section 5.2.4.11.

5.2.4.17 Hydroxyl Ethyl Cellulose (a Chemical Constituent of Mustard Lewisite, PCAS)

Information regarding this chemical is provided in Section 5.2.4.12.

5.2.4.18 Glycerol (a Chemical Constituent of Mustard Lewisite, PCAS)

Information regarding this chemical is provided in Section 5.2.4.13.

5.2.4.19 Methyl Salicylate (MES) (a Chemical Constituent of Mustard Lewisite, PCAS)

Information regarding this chemical is provided in Section 5.2.4.9.

5.2.4.20 2-2 Dipyridyl (a Chemical Constituent of CADS, PCAS)

Chemical Structure

$C_{10}H_8N_2$

General Description

2-2 Dipyridyl is an intermediate/product from manufacture of paraquat. It is found in waste water from paraquat production.

Environmental Fate

In aquatic systems, 2,2 Dipyridyl is not expected to bioconcentrate. It undergoes slow oxidation with photochemically generated hydroxyl radicals in aqueous solutions. 2,2 Dipyridyl should not partition from the water column to organic matter contained in sediments and suspended solids; and it should be highly mobile in soil and may leach to ground water. In the atmosphere, 2,2 Dipyridyl is expected to exist in both vapor and particulate phases. Vapor phase reactions with photochemically produced hydroxyl radicals should be important. In addition, 2,2 Dipyridyl has the potential to be physically removed from the air by wet deposition (HSDB 1987).

5.2.4.21 Phenolphthalein (a Chemical Constituent of CADS, PCAS)

Chemical Structure

$C_{20}H_{14}O_4$

General Description

Phenolphthalein is a colorless, tasteless compound with small crystal physical characteristics (Dietz et al. 1992, Lewis 1992). It is insoluble in water and very soluble in

chloroform (Lewis 1992). Phenolphthalein is widely used medically in laxatives, and chemically as an indicator agent.

Environmental Fate

No information available.

5.2.4.22 Isopropyl Alcohol (a Chemical Constituent of CADS, PCAS)

Chemical Structure

$(CH_3)_2CHOH$

General Description

Isopropyl alcohol is a colorless, volatile liquid that is highly flammable. It is infinitely soluble in water and is miscible in organic solvents. "Rubbing alcohol" consists of 30% water and 70% isopropyl alcohol (NIOSH 1976). Isopropyl alcohol is used to produce acetone, as a solvent, and in cosmetics and pharmaceuticals.

Environmental Fate

When isopropanol is released on land, it is apt to volatilize and leach into ground water and possibly biodegrade. Its fate in ground water is unknown. When released into water, isopropanol will volatilize and biodegrade. It will not adsorb to sediment or bioconcentrate in fish. In the atmosphere it will photodegrade primarily by reaction with hydroxyl radicals.

5.2.5 Non-specific Simulants

5.2.5.1 Titanium Dioxide

Chemical Structure

TiO_2

General Description

Titanium dioxide is a white amorphous powder used in military training to simulate brass. It is insoluble in water and hydrochloric acid, but dilutes in sulfuric acid and alcohol. Titanium dioxide is generally considered a nuisance dust (Hawley 1977).

Environmental Fate

A literature search revealed no information on the aquatic fate of titanium dioxide. However, Haley and Kurnas (1993) found TiO_2 eventually settles out of solution to the substrate below.

5.2.5.2 PEG 200 (Polyethylene Glycol)

Chemical Structure

(-CH2CH2O-)n, where n>=4. In general, each PEG is followed by a number indicating its general molecular weight, 200 in this case).

General Description.

PEG is a clear, viscous liquid or white solid which dissolves in water forming transparent solutions. It is soluble in many organic solvents. It is readily soluble in aliphatic hydrocarbons and has a sweet taste. Polyethylene glycols are used primarily as reactive intermediates for the manufacture of fatty acid ester surfactants and as solvents for gasoline processing. These compounds are also used as bases for cosmetic creams and lotions, pharmaceutical ointments, toothpaste formulations, binders, plasticizers, molding compounds, stiffening agents, and paper adhesives (HSDB 1987).

Environmental Fate

Due to it's high molecular weight and high viscosity, PEG has a low volatility. It is very soluble in water and is dissipated in water easily. A biochemical study of the biodegradation of PEG has shown that a number of microorganisms are capable of using PEG 200 and closely related compounds as a source of carbon and energy.

5.3 FREQUENCY AND EXPECTED USE

Table 9 summarizes the frequency and expected use of chemical stressors included in this ERA. Chemicals listed in Table 9 were carried through a screening risk assessment to develop a final list of chemicals of potential concern.

The frequency of mobile fog oil training we assessed was based on the estimated time each mobile smoke training area can be used. Pasquill categories, weather conditions, and other limiting factors defined in the Fort Leonard Wood air permit limit the time mobile smoke training can occur on each mobile smoke training area. We estimate conditions will permit deployment of fog oil no more than 20% of days each year on Ballard Hollow, 25% on Cannon Range (Mush Paddle Hollow), 40% on Musgrave Hollow, and 30% on Bailey McCann Hollow. The percentage of time each mobile smoke range can be used was assumed to be equal to the percentage of gallons to be used on the installation in a year. The analysis of effects of mobile fog oil training was based on the number of gallons of fog oil to be deployed at each mobile smoke training area (Attachment I, Table I-5).

TABLE 9. Properties of chemical stressors.

Chemical Stressor	Intended Use	Maximum Daily Quantity	Expected Yearly Quantity	Frequency of Use (Day and Night)	Location of Use
Smokes and Obscurants					
Fog Oil	Smoke obscurant	1200 gallons	static (gal) OPTM: 8500 mobile (gal) OPTM: 76,000	static: 7.1 days per year mobile: 63 days per year	Smoke Training Areas
TPA	smoke obscurant				
M83	smoke obscurant	141 maximum	3136 units 2242 grenades from 1 November through 15 March	131 days per year	22 smoke grenade training locations
M8 TA, TPA smoke pots	smoke obscurant	59 maximum	950 units	16 days per year	9 smoke pot training locations
BIDS and FOX Training Simulants					
Bacillus subtillus	simulate biological warfare agent	9 ml 1.5 kg	180 ml 22.5 kg	20 days per year (indoors) 15 training days (outdoors)	BIDS Exterior
Male specific coliphage	simulate biological warfare agent	9 ml	180 ml	20 days per year	BIDS (outdoors)
Erwinia herbicola	simulate biological warfare agent	9 ml	180 ml	20 days per year	BIDS (outdoors)

Chemical Stressor	Intended Use	Maximum Daily Quantity	Expected Yearly Quantity	Frequency of Use (Day and Night)	Location of Use
Ovalbumin	simulate biological warfare agent	9 ml	180 ml	20 days per year	BIDS (outdoors)
Kaolin	simulate biological warfare agent	5.5 kg	11 kg	2 days per year	BIDS (outdoors)
Anisole	FOX simulant	9 ml	30 ml	approx. 4 days per year	FOX (indoors)
Benzaldehyde	FOX simulant	5 ml	30 ml	6 days per year	FOX (indoors)
Cyclohexanone	FOX simulant	5 ml	30 ml	6 days per year	FOX (indoors)
DEM - Diethyl malonate	FOX simulant	5 ml	19.03 l	6 days per year	FOX (indoors)
Diethyl phthalate	FOX simulant	200 ml	1.2 l	approx. 10. days per year	FOX (indoors)
Dimethyl phthalate	FOX simulant	2 ml 8 ml	12 ml 48 ml	6 days per year 6 days per year	FOX (indoors) outdoors
Ethyl phthalate	FOX simulant	1 ml 4 ml	6 ml 24 ml	6 days per year 6 days per year	FOX (indoors) outdoors
Eucalyptol	FOX simulant	1 l	6 l	6 days per year	FOX (indoors)
MES - Methyl Salicylate	FOX simulant	5 ml	15.03 l	6 days per year	FOX (indoors)
Persistent Chemical Agent Simulants (PCAS)					
Soman (GD)	PCAS	9 l	1800 l	200 days per year	Chemical Training Courses (outdoors)

Chemical Stressor	Intended Use	Maximum Daily Quantity	Expected Yearly Quantity	Frequency of Use (Day and Night)	Location of Use
Sodium carbonate (2%)	PCAS	0.18 l	36 l	200 days per year	Chemical Training Courses (outdoors)
Polyethylene oxide (1%)	PCAS	0.09 l	18 l	200 days per year	Chemical Training Courses (outdoors)
Hydroxyethyl cellulose (0.4%)	PCAS	0.04 l	7.2 l	200 days per year	Chemical Training Courses (outdoors)
Glycerol (10%)	PCAS	0.9 l	180 l	200 days per year	Chemical Training Courses (outdoors)
Diethyl malonate (13%)	PCAS	1.2 l	234 l	200 days per year	Chemical Training Courses (outdoors)
Mustard Lewisite	PCAS	9 l	1800 l	200 days per year	Chemical Training Courses (outdoors)
Ferrous ammonium sulfate (2%)	PCAS	180 ml	36 l	200 days per year	Chemical Training Courses (outdoors)
Polyethylene oxide (0.3%)	PCAS	27 ml	5.4 l	200 days per year	Chemical Training Courses (outdoors)
Hydroxyethyl cellulose (0.4%)	PCAS	36 ml	7.2 l	200 days per year	Chemical

Chemical Stressor	Intended Use	Maximum Daily Quantity	Expected Yearly Quantity	Frequency of Use (Day and Night)	Location of Use
					Training Courses (outdoors)
Glycerol (10%)	PCAS	900 ml	180 l	200 days per year	Chemical Training Courses (outdoors)
Methyl salicylate (13%)	PCAS	1170 ml	234 l	200 days per year	Chemical Training Courses (outdoors)
CADS	PCAS	9 pts	1800 pts	200 days per year	Chemical Training Courses (outdoors)
2,2 Dipyridyl (0.5%)	PCAS	0.045 pts	9 pts	200 days per year	Chemical Training Courses (outdoors)
Phenophthalein (1%)	PCAS	0.09 pts	18 pts	200 days per year	Chemical Training Courses (outdoors)
Isopropanol (70%)	PCAS	6.3 pts	1260 pts	200 days per year	Chemical Training Courses (outdoors)
Non-specific Simulants					
Titanium dioxide M82 grenade	Simulates brass obscurant grenades	24 units	48 units	2 days per year	22 Grenade Training Locations
PEG 200 (mixed butyl mercaptan)	Simulates toxic rain attack	NA	50 gallons	NA	Maximum of 8 Sites

Section 6
Methods

Section VI:

Methods

6.1 CAVE MAPPING

Volumes and dimensions of Brooks, Wolf Den, Davis No. 2, Saltpeter No. 3, Freeman, and Joy caves were determined to model air flow and stressor movement within the caves.

6.2 CAVE METEOROLOGICAL AIR FLOW STUDIES

To determine chemical stressor behavior in endangered bat caves, we monitored cave climatic conditions. Meteorological stations were designed to collect climate information inside and outside caves. Meteorological stations were installed at each of the 4 Indiana bat hibernacula (Brooks, Wolf Den, Davis No. 2 and Joy caves), and two gray bat caves (Saltpeter No. 3 and Freeman caves). There were two meteorological stations at each cave. External stations were set up approximately 9 m from the outside of the entrance of caves and internal stations were approximately 30 m from the entrance of the caves.

Each external meteorological station consisted of the following: a 2-m tripod with lightning rod; solar panel; temperature/relative humidity sensor; barometric pressure sensor; anemometer; wind vane; antenna; and control box with interface, computer interface module, battery, cellular transceiver, and storage module. Internal stations have the following components: a 2-m tripod, small box with barometric pressure sensor, temperature/relative humidity sensor, anemometer and wind vane.

6.2.1 Determination of Mixing Constants

We measured the mixing constant in each of the 6 bat caves at Fort Leonard Wood. A particle mist nebulizer was used to generate particles in each of the caves. We used a Met One particle cell counter to determine the concentration and size of particles remaining in the air over a period of time. We used this information to calculate the mixing constant for each cave based on the size of the particles and amount of time they remained in the air after generation and release.

6.2.2 Monitoring Bat Roost Locations in the Caves

One bat roost was selected within each cave. Each location was equipped with a HOBO® barometric pressure mini datalogger sensor, a HOBO® temperature mini datalogger sensor, and a Stowaway™ relative humidity mini datalogger sensor. Data were downloaded using Logbook® software.

6.2.3 Maintenance of Meteorological Stations

Stations were maintained every 30 days or as needed. An IBM Thinkpad laptop computer equipped with PC 208 software was used to download data from the weather stations. A computer in Cincinnati, Ohio, downloaded data from the computers at Brooks, Wolf Den, Joy, and Freeman Caves via modem. Cellular phone coverage could not reach Saltpeter No. 3 and Davis No. 2, presumably because of topography. The transceivers were taken out of these 2 stations to reduce battery use. As a result, Saltpeter No. 3, Joy, and Davis No. 2 were visited every 30 days to download the data. If the computer in Cincinnati had trouble communicating with a station between visits, that station was checked. As photoperiod shortened, solar panels failed to fully charge batteries at all caves except Freeman. To remedy this, 12-volt marine batteries were added to the 6 cave stations.

6.2.4 Air Dispersion Modeling for Exposure Concentrations

The complex air flow patterns in caves make detailed mathematical modeling of smoke transport and diffusion into caves difficult and time consuming. However, simple material balances can be used to estimate and interpret real time exposure data from external smoke sources so that the cave roost/hibernation area mixing factor can be determined. By using this

method the cave smoke intake and dilution characteristics can be estimated to determine the smoke exposure level and ascertain if the exposure level is below acceptable limits.

A material balance method for work area rooms is described in a National Institute for Occupational Safety and Health (NIOSH) report, "Analyzing Workplace Exposures Using Direct Reading Instruments and Video Exposure Monitoring Techniques" (1992 U.S. Dept. of Health and Human Services). NIOSH uses this method to analyze and evaluate human exposure in enclosed, potentially contaminated work places. We used this method to evaluate the exposure of bats in caves to military smokes at Fort Leonard Wood.

6.2.4.1 Dilution Ventilation and Material Balance

The concentration of smoke at any time in a cave area can be expressed as a differential material balance. When integrated over an exposure period, the material balance provides a rational basis for relating cave ventilation rate to the generation and removal of smoke from a cave area. The material balance is

ACCUMULATION RATE = GENERATION RATE - REMOVAL RATE

$$VdC = Gdt - \frac{QC}{K}dt \qquad 1.$$

where:

V = effective volume of the roost/hibernation area
C = concentration of smoke in the roost/hibernation area at time t
G = generation rate of smoke in the roost/hibernation area
t = time
Q = roost/hibernation area rate of ventilation (volume per unit time)
K = roost/hibernation area mixing constant.
d = derivative

Assuming the effective volume of the roost/hibernation area (V), the generation rate of the smoke (G) (which is assumed to be the product of the concentration from a distant smoke generator produced at the mouth of the cave and the rate of ventilation into the cave), the roost/hibernation area rate of ventilation (Q), and the mixing constant (K) during the smoke exposure are constant. Equation 1 can then be arranged as

$$\int_{C_{t_1}}^{C_{t_2}} \frac{dC}{G - \frac{QC}{K}} = \frac{1}{V}\int_{t_1}^{t_2} dt \qquad 2.$$

where:

C_{t1} = concentration at time t_1
C_{t2} = concentration at time t_2

Equation 2 can be solved to obtain

$$C_{t_2} = \frac{KG}{Q}\left[1 - \exp(-\frac{Q}{KV}(t_2 - t_1))\right] + C_{t_1}\exp(-\frac{Q}{KV}(t_2 - t_1)) \qquad 3.$$

Air changes per unit time (Q/V) is the ratio of roost/hibernation area rate of ventilation to the volume of the roost/hibernation area. When the roost/hibernation area is equally open at either end and not at least partially enclosed, the rate of ventilation is

$$Q = A\vec{v} \qquad 4.$$

where:

A = is the cross-sectional area of the roost/hibernation area
$\vec{v}$ = is the normal flow velocity to the cross-sectional area.

Equation 4 also applies if the roost/ventilation area is room-like with a single opening for entrance and exit (that is the room door). In this case A is the cross-sectional area of the "room door" and $\vec{v}$ is the net air velocity into or out of the room.

Equations 3 and 4 indicate the physical measurements of the cave required for estimating the smoke exposure in the roost/hibernation area. We measured temperature, barometric pressure, air speed and direction, and relative humidity are being measured inside and outside caves to compute or measure directly the ventilation rate, or air velocity normal to cross-sectional area of the roost/hibernation area. We measured the cave roost/area cross-sectional areas and room volumes. The generation rate of smoke in the roost/hibernation area is

$$G = C_{smoke} Q_{cave} \qquad 5.$$

where:

C_{smoke} = concentration of smoke at the entrance to the cave as computed by an atmospheric transport and diffusion model for smokes such as TREMS1.
Q_{cave} = cave entrance ventilation rate which functionally is the same as that expressed by Eq. 4, except A is the cross-sectional area of the cave entrance and $\vec{v}$ is the net velocity into the cave (which is determined for example by measurement of barometric pressure and temperature differences).

The mixing constant adjusts for incomplete mixing of the ventilation air in the roost/hibernation area. Like the ratio Q/V, the mixing constant, K, affects the rate at which an equilibrium concentration is reached and directly affects equilibrium concentration which Eq. 3 shows is

$$C_{t_2} = \frac{KG}{Q} \qquad 6.$$

When smoke is no longer at the cave entrance, *G=0*, Eq. 3 reduces to an exponential decay of an equilibrate concentration. The mixing constant can be estimated by solving the following equation for K:

$$C_{t_2} = C_{t_1} \exp(-\frac{Q}{KV}(t_2 - t_1)) \qquad 7.$$

K is specific to the roost/hibernation area, location within the roost/hibernation, and other environmental conditions at the time of sampling. We measured K in all six caves using a continuous source of water vapor to establish an initial concentration which was then turned off and allowed to decay. The concentration as a function of time during concentration decay was then used to measure K at representative locations in the roost/hibernation area. If a particular K value is chosen for reference, values greater than the comparison value show the corresponding ventilation rate is less than the reference value and the decay of the smoke is slower than that corresponding to the reference value. Values less than the reference value show the corresponding ventilation rate is greater than the reference value and the decay of

the smoke is faster than that corresponding to the reference value. The build up and decay of smoke in a roost/hibernation area as well as the location of the bats in relation to the source of the smoke affect the concentration in the breathing zone of the bat, and thus real-time exposure data.

6.2.4.2 Selection Criteria for Air Dispersion Models

Smoke transport and diffusion models now commonly used in environmental evaluations for air quality and for first order tactical analysis by the Army use a Gaussian plume or puff analysis. These models assume the aerosol mass concentration distribution as a function of downwind distance from the source can be expressed as a Gaussian distribution. Implicit in this assumption is that the predicted mass concentrations represent spatial and time averages and that the meteorological conditions used for model input are constant for the prediction.

Meteorological conditions used in Gaussian plume models include:

1. plume axis wind speed,
2. wind speed as a function of altitude,
3. surface roughness,
4. atmospheric stability, and
5. height of inversion layers.

For a single source, the peak mass concentration as a function of downwind distance from the source is linearly proportional to the rate at which the smoke is produced and inversely proportional to the product of the wind speed and the horizontal and vertical standard deviations. The standard deviations in Gaussian aerosol transport and diffusion models are expressed as power laws of down wind distance with the exponents dependent on surface roughness and atmospheric stability.

Normally, within the first 2000 - 3000 m of the boundary layer wind speed increases with altitude. For example, wind speed at head height can be 5 - 7 times slower than at a 10 m height. One of the primary differences in various Gaussian plume models is how wind speed with altitude is treated. A common approach is to model the wind speed as increasing with altitude as a power law. The exponent in the wind speed with altitude power law is assumed to depend on surface roughness and atmospheric stability.

Surface roughness is a nonlinear parameter used to adjust the standard deviations in the Gaussian concentration distributions for terrain variations. For example, a 0.1 m surface roughness corresponds to flat terrain covered with 1 - 2 m high grass or bushes. A 1 m surface roughness corresponds to hilly terrain covered with 10 - 15 m high trees or an urban environment with numerous high buildings.

Atmospheric stability depends primarily on background wind speed, temperatures, and radiative loading. It can not be measured directly, and is normally expressed as Pasquill-Gifford (P - G) category A - G, A being highly unstable and G being highly stable. A and B P - G categories normally occur on sunny days between 1100 and 1400 h. C and D P - G categories normally occur on sunny days from about 0700 to 1000 h, and between 1400 and 1800 h. E, F, and G categories normally occur before 0700 h and after 1900 h. It is important to understand that atmospheric stability is a dynamic variable that can fluctuate over times of the order of minutes due to fluctuating radiative loading resulting from, for example, changes in cloud cover. Atmospheric stability is expressed in Gaussian plume models as changes in the standard deviations.

Heights of inversion layers can range from tens of meters to over 1000 m. Inversions occur where air at altitude becomes warmer than that at ground level. The inversion layer reflects the upward drift of a smoke plume back into that at lower altitudes making the smoke concentrations higher than would otherwise be expected. Height of the inversion layer can be highly variable, particularly in the early morning and late afternoon hours where cool air collects in shadowed valleys while air over ridges and hills exposed to sun light remains warm.

The net effect of all the above meteorological parameters on Gaussian plume transport and diffusion computations is to make mandatory localized and accurate measurements of meteorological conditions at least at sites where smokes are to be released, and more reasonably at downwind locations where smoke concentrations are significant. Meteorological measurements older than a few minutes and at locations several kilometers, much less several tens of kilometers, removed from the area in question are not appropriate for Gaussian plume models.

Atmospheric transport and diffusion models accepted by the Environmental Protection Agency assume some form of Gaussian transport and diffusion. These models are typically

fine-tuned (specialized standard deviations, etc.) for smoke releases from elevated sources over flat terrain with constant surface roughness and meteorological inputs that are representative of large surface areas and at elevated altitudes.

The Tactical Resources Evaluation Modeling System for liquid obscurants (TREMS1) uses a Gaussian plume model with Pasquill-Gifford stability expressions for plume concentration spatial standard deviations. The TREMS1 standard deviation values are commonly used in most accessible U.S. Army atmospheric transport and diffusion models. TREMS1 does not account directly for variability in terrain height relative to generator location. Terrain roughness is accounted for through values chosen for the downwind concentration standard deviations. TREMS1 assumes continuous smoke production and constant atmospheric conditions.

For the air dispersion computations herein, the computational output of TREMS1 was configured to produce contours of constant concentration at a fixed height relative to the source after the plume was established.

The EPA has not used TREMS1, and because the model does not directly account for terrain height variations, the validity and acceptability to the EPA of TREMS1 computational values is uncertain relative to models the EPA has used. During a meeting of support contractors assessing effects of smoke training at Fort Leonard Wood it was suggested the EPA recognized models INPUFF 2.3 and ISC 3.0 apparently provide for terrain variations and may more accurately yield a "better" estimate downwind smoke concentrations. Both INPUFF 2.3 and ISC 3.0 are Gaussian models. However, INPUFF produces a plume by requiring the source to produce a series of smoke puffs that are closely spaced in time, and can make allowance for temporal changes in meteorological conditions while TREMS1 and ISC 3.0 are true continuous source plume models.

Evaluation of INPUFF 2.3 shows the computational output format allows the user to specify "receptor" (that is, the concentration sample point) height as a function of downwind spatial grid location. However, examination of INPUFF 2.3 shows that the model does not directly account for terrain variations. It assumes flat terrain and that variations in terrain height are equivalent to simple changes in receptor height.

The concern expressed relative to the acceptability of TREMS1 to the EPA and its predictive accuracy for complex terrain led to work on a comparison of TREMS1, INPUFF 2.3, and ISC 3.0 to determine which model is best to use for Fort Leonard Wood smoke transport and diffusion environmental computations. The criteria for model selection included but were not necessarily limited to:

1. ease of use,
2. sensitivity to terrain variations or surface roughness,
3. applicability and acceptability for predicting U.S. Army smoke generator performance,
4. production of conservative predictions, and
5. acceptability of prediction results to the EPA and state authorities.

The first criteria reflects the desire to obtain predictions in an easily interpretable format by environmental analysts. The second and third criteria reflect a desire to have the model accurately describe source and terrain environment effects on smoke transport and diffusion. The forth and fifth criteria require predictions conservatively estimate the area coverage for a given concentration threshold, and that the results are acceptable to regulatory authorities. We used the fourth criterion as the basis of the selection of the air dispersion model for fog oil in the BRAC ERA. In the ecological risk assessment, the most conservative analysis is used to determine if an unacceptable exposure is occurring.

Section 7
Stressor Toxicity Profiles

Section VII:

Stressor Toxicity Profiles

7.1 INTRODUCTION

To determine if species of concern will be exposed to "unsafe" or toxic concentrations of stressors, we identified concentrations that could cause an adverse effect.

Until recent years, most toxicology research and ecological risk assessment was focused on humans. There is an established EPA hierarchy to collect human toxicity data for human health risk assessments. There also is an established protocol on how to apply toxicity information. There is no established protocol for non-human species, ecosystems, communities, etc. Several guidance documents that provide insight and develop approaches to estimate toxic effects from environmental stressors are now available from EPA and DOD.

We evaluated each stressor for acute and chronic toxicological effects. Typically, acute effects are exhibited by organisms exposed to high concentrations over a short period of time. Acute toxicity tests are designed to assess short-term exposure. Acute exposure results from on exposure event. We did not consider short term simultaneous exposure to multiple stressors because there are no developed toxicological studies that examine all stressors in this study. Also, we were unable to accurately predict the simultaneous timing, area of use, and other factors needed to evaluate effects of multiple stressors.

Chronic toxicity tests assess long-term toxicological effects. These tests are used to determine if there are expected effects to the receptor after multiple exposures to a stressor. The EPA (1989) describes chronic exposure for humans as anything occurring for 7 years or 10% of the average human lifespan. Chronic tests include doses that are typically representative of expected field exposures.

This toxicity used in assessments established safe doses of stressors. For certain chemicals, the EPA has established a safe dose, called Reference Dose (RfD). The RfD is used to assess noncarcinogenic effects resulting from exposures at Superfund sites (EPA 1989). RfDs are published in the IRIS (Integrated Risk Information System) database. Many human RfDs are developed from animal toxicological studies. The RfD is based on the highest dose administered that does not cause an adverse effect (NOAEL = No Observable Adverse Effect Level).

Most human toxicity data is based on animal studies. Uncertainties exist when using a different test species (surrogate) than the study species. Uncertainty factors are used to lower the toxicity values in case the study organism is more sensitive, has different metabolic rates, or has other physiological or anatomical differences. There is uncertainty introduced in assuming the test organism will exhibit the same effect as manifested in the surrogate species. The EPA uses Uncertainty Factors (UF) to address this issue. The NOAEL for a surrogate species is divided by the product of UFs to yield a toxicity value for the test organism. A Lowest Observable Adverse Effect Level (LOAEL) is used if the NOAEL is not available. The study from which the NOAEL was selected is called the "critical study" and the effect manifested in the study is called the "critical effect."

There are few established toxicity values for wildlife or other non-human organisms. We developed toxicity values using methods similar to those used to develop mammalian RfDs. The Department of Defense (DOD) Procedural Guidelines for Ecological Risk Assessments at U.S. Army Sites (Wentsel 1994) refers to the use of Toxicity Reference Values (TRVs) in place of RfDs. We developed a TRV for inhalation, ingestion, and dermal absorption from toxicological studies. Calabrese and Baldwin (1993) outline another procedure to develop TRVs, but with slightly different UF adjustments. We used the decision tree with the uncertainty factor values presented in Wentsel et al. (1994). This procedure involves assumptions about the test species and the receptors in this analysis:

- similar toxic response in test species and receptors
- similar pharmacodynamics
- similar sensitivity to the stressor in test species and receptor
- similar stressor behavior in test species and receptors
- similar pharmacokinetics

We applied the UFs to reduce the NOAEL to account for differences in our receptors and the test species. UFs account for differences within species, between species, between toxicological values, sensitivities, and differences between taxonomic class of the test organism and the study species.

We evaluated oral ingestion, inhalation, and dermal absorption routes of exposure. Chemicals ingested enter the digestive system where they are metabolized or excreted. Effects from ingested stressors are typically shot-term, and alleviated with removal of the stressor. Absorption efficiency was not evaluated. Inhaled toxicants may damage the lungs and cause systemic effects. The lung membrane has a large surface area over which gas exchange occurs. Many toxicants irritate dermal coverings.

Toxicological responses vary with receptor species. Figures 6, 7, 8, and 9 illustrate the differences in anatomy and disease response for Indiana bats, gray bats, and bald eagles. Indiana bats and gray bats respond to contaminants similarly. Bald eagles have anatomical features that mammals lack (i.e. a crop and gizzard). Indiana bats, gray bats and bald eagles are affected by different toxicological effects from stressors (Figures 6, 7, 8, and 9).

7.2 SMOKE AND OBSCURANTS

7.2.1 Fog Oil

7.2.1.1 Chemical Structure

Hydrocarbons, C_5 to C_{50}

Studies referenced in this section were conducted on old fog oil. It is not known whether new fog oil will cause the same or similar effects as old fog oil. Because of the

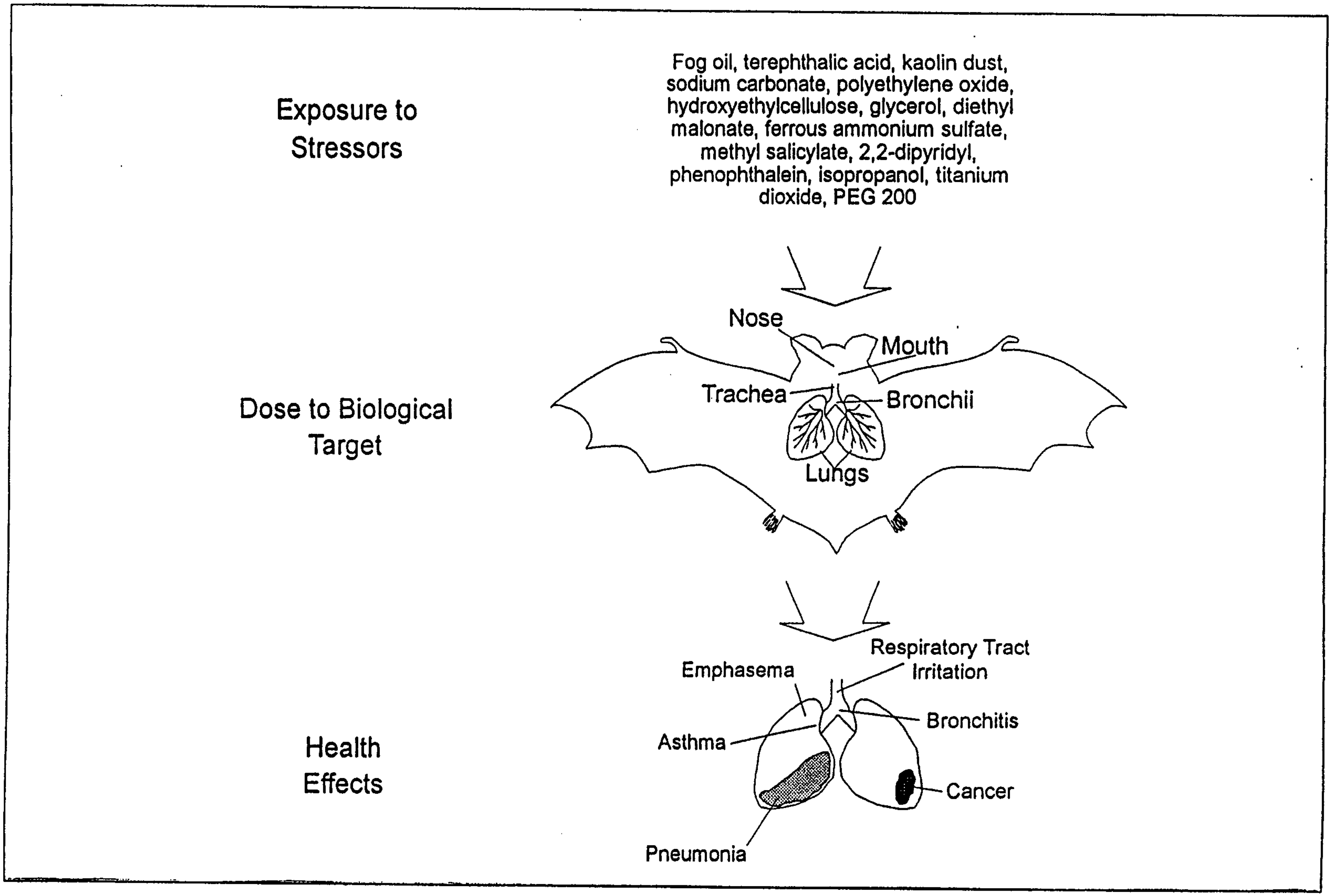


FIGURE 6. Model of possible toxicological effects to Indiana bats and gray bats inhaling chemical stressors.

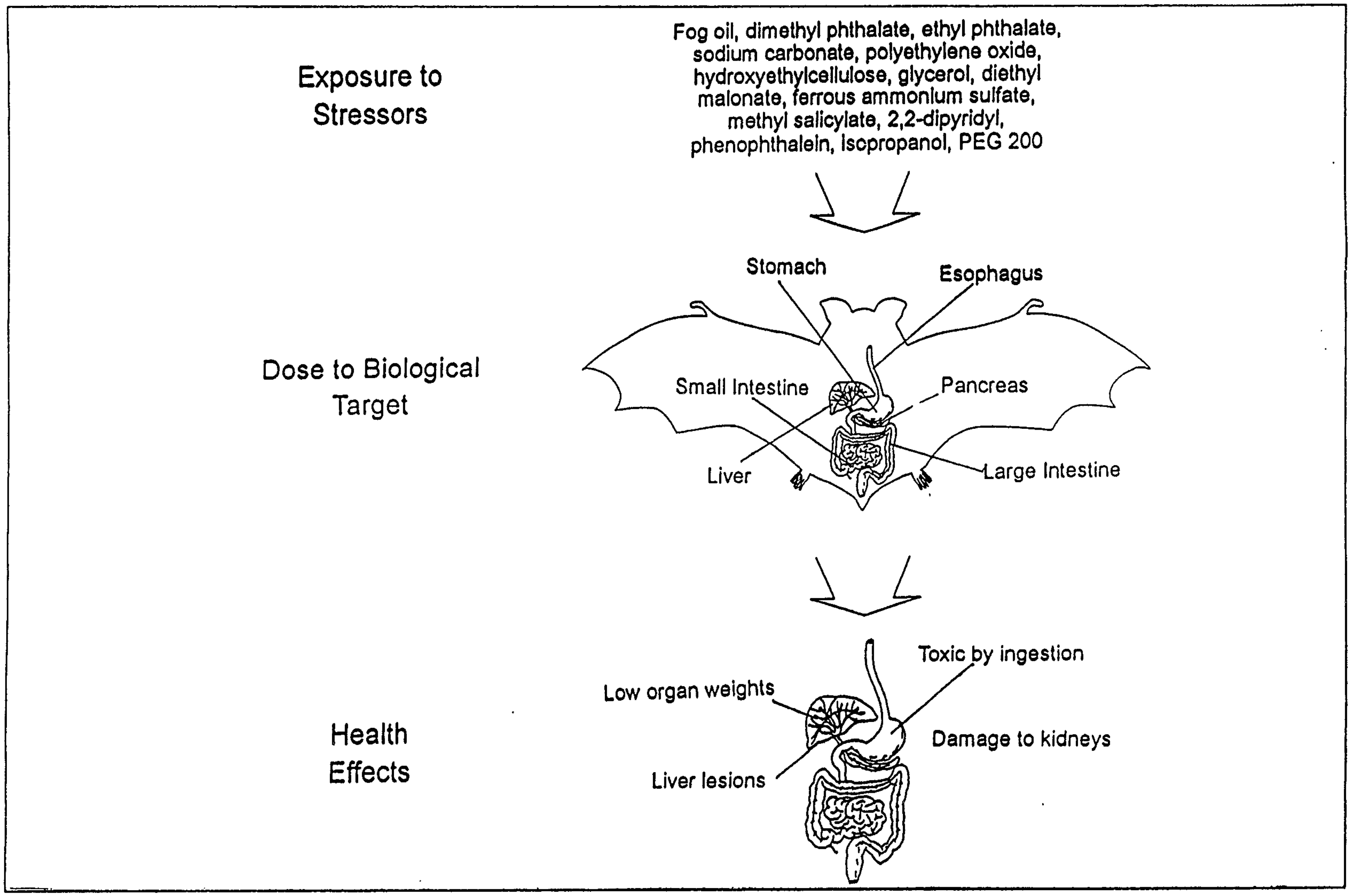


FIGURE 7. Model of possible toxicological effects to Indiana bats and gray bats ingesting chemical stressors.

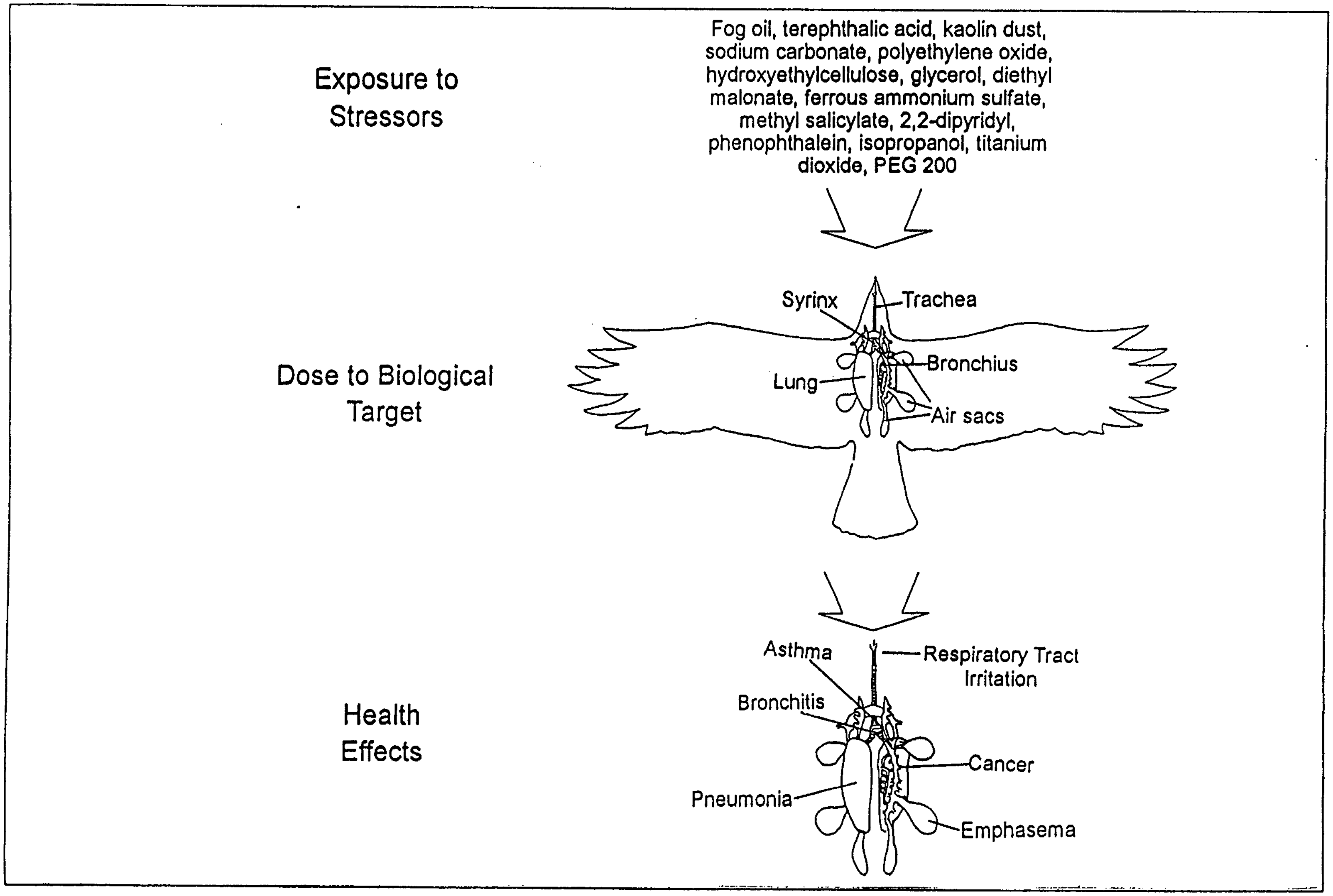


FIGURE 8. Model of possible toxicological effects to bald eagles inhaling chemical stressors.

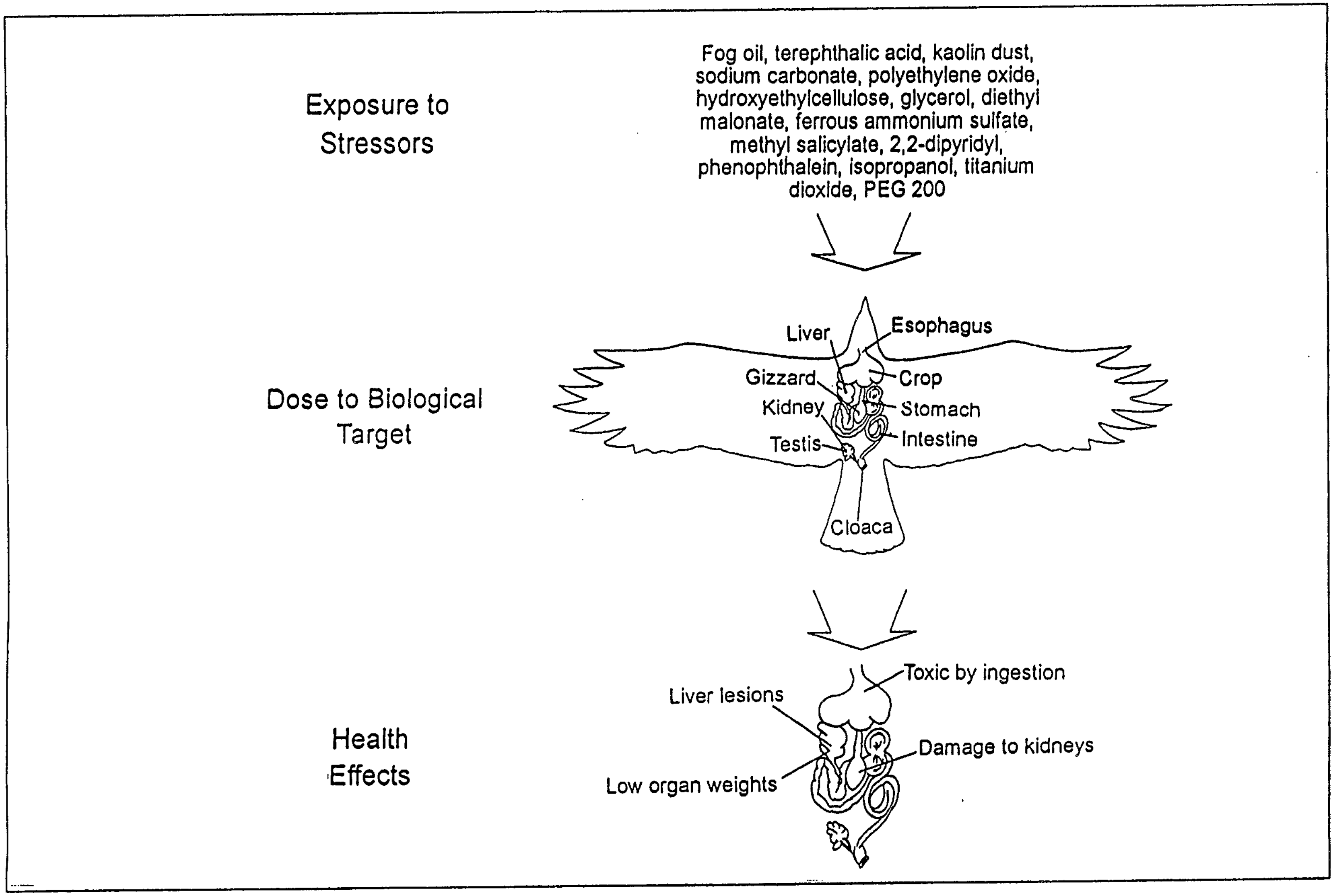


FIGURE 9. Model of possible toxicological effects to bald eagles ingesting chemical stressors.

extensive hydrotreating new fog oil undergoes before it is purchased by the military, toxicological effects and toxicity values from new fog oil are not expected to as severe as old fog oil. Hydrotreating of the new fog oil removes carcinogenic compounds.

7.2.1.2 Oral Ingestion

Acute toxicity of fog oil is low in animals (Palmer 1990). A similar petroleum product, white mineral oil, is lethal to mice in doses of 5 - 20 ml/kg (Driver et al. 1992). Repeated exposure to large doses may cause serious effects. Daily ingestion of 5 or 20 ml/kg white mineral oil caused weight loss, degeneration of liver and kidney, restlessness, and epidermal damage; animals died within 7 - 10 days (Mulhy et al. 1983). In rats and rabbits, ingestion of fog oil is rarely acutely toxic (Palmer 1990).

7.2.1.3 Dermal Absorption

Fog oil used for obscuration is not considered a skin sensitizer or eye irritant. In humans, short-term dermal exposure to petroleum oils may cause redness (Palmer 1990). Dermal application of 0.6 ml yellow or white lubricating oil on guinea pigs for 2 days caused redness, hyperkeratosis, and desquamation (Mulhy et al. 1983).

Prolonged or repeated skin exposure to petroleum products can cause reversible inflammation, acanthosis, and eczema (Palmer 1990, Smith et al. 1987). Repeated dermal exposure to refined oils (similar to fog oil) changed epidermal morphology and caused hair loss (Palmer 1990). The refining process of "new" fog oil removes a significant proportion of PAHs, and few chronic skin problems, including tumorigenesis, are expected (Palmer 1990).

7.2.1.4 Inhalation

The minute size of fog oil droplets (0.5 - 1 μm) facilitates respiratory exposure (Palmer 1990, Young et al. 1989). Viscosity of fog oil is low and respiratory toxicity is lower than thicker oil mists (Driver et al. 1992). The LC_{50} for rats was calculated at 5.2 mg/L in a single 3.5 hours exposure (Grose et al. 1985, Selgrade et al. 1987). Exposure of male rats to 1.5 mg/L fog oil for 6 hours per day for 2 days caused 70% mortality due to pulmonary hemorrhage (Selgrade et al. 1987). After inhalation of high doses (4330 - 4500 mg/m^3) for 2 - 92 hours, mice retained significant amounts of oil in the bronchioles and alveoli and a few deaths occurred (Mulhy et al.

1983). The short-term exposure limit for human exposure to mineral oil (chemically and toxicologically similar to fog oil) is 10 mg/m^3 for 15 min (Driver et al. 1992).

Adverse pulmonary and systemic effects may result from prolonged or repeated exposure to fog oil. In humans, exposure to refined oils may cause respiratory granulomas and pneumonias (Palmer 1990). Rats exposed to 1.5 mg/L SGF-2 fog oil for 4 weeks exhibited multi-focal pneumonitis, edema, and inflammation (Grose et al. 1986, Selgrade et al. 1987). These symptoms were rarely observed in rats exposed to 0.5 mg/L SGF-2 for 4 weeks (Selgrade et al. 1987). However, rats exposed to similar doses for 13 weeks had more severe histopathologic changes and pulmonary effects at lower doses (Selgrade et al. 1990). Exposure to fog oil for 4 - 13 weeks suppressed feeding and caused significant weight loss (Grose et al. 1985). None of these effects seemed life threatening and pulmonary functions such as total lung capacity, vital capacity, residual volume, diffusing capacity of CO_2, and lung compliance were unaffected by fog oil exposure (Grose et al. 1985, Selgrade et al. 1987).

Nearly all monkeys exposed to 63 mg/m^3 SGF-1 fog oil died within one year, suffering from pneumonitis, other pulmonary damage, and severe gastritis (Lushbaugh 1950). Rats and dogs exposed to 100 mg/m^3 mineral oil for one year also contracted pulmonary damage (Wagner et al. 1964). No pulmonary damage was caused in rats exposed to 5 mg/m^3 mineral oil for one year (Wagner et al. 1964). An 8 hour time weighted average exposure limit of 5 mg/m^3 is advised for humans (Palmer 1990).

7.2.1.5 Carcinogenicity/Teratogenicity

The International Agency for Research of Cancer lists some napthenic and paraffinic-based mineral oil as carcinogens or probable carcinogens. However, several studies of humans have found no association between inhalation of oil mist and lung cancer (Shinn et al. 1987). Chronic ingestion of highly refined mineral oils is not known to cause cancer in animals (Palmer 1990, Oser et al. 1965). No carcinogenic effects were observed in rats fed 2% liquid paraffin for 500 days or rats fed 5% petrolatum for two years (Palmer 1990). Liquid paraffin and petrolatum are similar to mineral oil. Oser et al. (1965) conducted a study that found no oil-related tumors observed in rats fed 5% diets of 3 grades of petrolatum for 2 years. Inhalation of 5 and 100 mg/m^3 of mineral oil for 13 months caused no difference in the

incidence of tumors in mice (Palmer 1990). Studies of the carcinogenicity of "old" fog oil by dermal absorption are inconclusive (Palmer 1990).

Solvent refining processes are known to remove many cancer-causing factors, including PAHs, from "new" fog oil (Gehrart et al. 1988). However, Palmer (1990) found that stockpiles of fog oil may not be noncarcinogenic, especially if producers only use OSHA specifications as a guideline.

7.2.1.6 Wildlife Exposure

Little data exist describing the toxicity of fog oil to wildlife and all current available information is based on old fog oil. Small animals breathe a larger volume of air per unit body weight than humans; wildlife may be more susceptible to effects of inhalation of fog oil (Driver et al. 1992). Old fog oil has been proven to be weakly mutagenic to rodents exposed in the wild (Yanders et al. 1985). Herbivores may ingest oils from plants because petroleum oils are known to penetrate leaves, fruit, and tubers of some species (Mulhy et al. 1983). We found no evidence of fog oil accumulating in the environment or biota (especially vegetation) at Fort McClellan (see Section 10). Old fog oil can accumulate in food chains, especially in aquatic situations (Shinn et al. 1987). Oil coating water can deplete dissolved oxygen and asphyxiate aquatic organisms; however, tests indicate fog oil has limited potential to reduce dissolved oxygen (Driver et al. 1992).

Studies have shown effects of exposure to fog oil in waterfowl, aquatic organisms, and invertebrates. In ducks, ingestion of 20 mL/kg lubricating oil or 24 mL/kg diesel oil caused no mortality. Other studies revealed systemic damage from doses as low as 1 mL/kg lubricating oil or 3 mL/kg diesel oil (Mulhy et al. 1983). Coating of avian feathers with petroleum products may inhibit thermoregulation, buoyancy, and escape from predators (Driver et al. 1992). In quail, ingestion of 3.5 mL/kg of No. 2 fuel oil delayed egg production and caused abnormalities in egg formation (Mulhy et al. 1983). Painting shells of viable chicken eggs with 2 - 30 μL crude oil caused edema in subcutaneous tissue, necrosis of liver, and dilation of heart and spleen of embryos. Coating less than 2% of the surface area of eggs with 1 μL of No. 2 fuel oil was lethal to embryos (Driver et al. 1992). Toxicity of petroleum products to eggs may be related to PAH content of the oil. New fog oil contains little if any PAH compounds; it is assumed to have reduced toxicity.

Most species of fish can tolerate 24 hour exposures to 28 - 52.5 mg/L of No. 2 fuel oil added to water, although some minnows tolerate up to 260 mg/L (Mulhy et al. 1983). When No. 2 fuel oil was dissolved in water, tolerance to oil was much lower (3.9 - 6.9 mg/L). The fathead minnow (*Pimephales promelas*) was not adversely affected by 0.16 - 2.37 mg/L fog oil (Driver et al. 1992). Marine annelids tolerated 24 hour exposures to 8.7 mg/L No. 2 fuel oil dissolved in water (Mulhy et al. 1983). Fog oil residues of 285 μg/g (3600 $\mu g/cm^3$) in soil had no apparent effect on survival of adult or larval earthworms (Driver et al. 1992). For the freshwater invertebrate, *Daphnia magna*, exposure to 8.96 mg/l of fog oil was lethal (Driver et al. 1992). Exposure to 12.5 mg/L No. 2 fuel oil in water was lethal to scallops within 24 hours (Mulhy et al. 1983). Exposure to 1000 mg/L No 2. fuel oil in water reduced development of oyster and mussel larvae (Mulhy et al. 1983). Larvae of marine shrimp tolerated 24 hour exposures to 2.6 - 5.0 mg/L No. 2 fuel oil dissolved in water (Mulhy et al. 1983). Larval shrimp tolerated smaller doses for longer exposures.

Impact areas for obscurant training are typically small (Driver et al. 1993) and Shinn et al. (1987) predicted toxic effects of fog oil clouds on terrestrial species will be minimal if testing is limited to short periods of time.

7.2.2 Terephthalic Acid

7.2.2.1 Chemical Structure

$C_6H_4(COOH)_2$

7.2.2.2 Oral Ingestion

Ingestion of a diet with 5% TPA for two years caused death in rats (Woodward 1986). The rats died primarily of nephropathy caused by bladder calculi. Damage to the ureter and urinary bladder also were observed. In other studies, ingestion of > 2% TPA for less than two weeks caused formation of uroliths (Woodward 1986); rats ingested 85 mg/kg of TPA with no accumulation or toxic effects (EPA 1982). Eastman Chemical Products, Inc. determined LD_{50} of TPA to mice to be 6400 mg/kg (Moffit et al. 1975). NIOSH gives an oral LD_{50} in rats for TPA of 18,800 mg/kg (EPA 1982).

7.2.2.3 Dermal Absorption

No evidence of skin irritation in rats was found after single and repeated application of 80 mg. This dose was also shown not to absorb into the skin or eyes of rabbits (Thomson et al. 1988, Muse et al. 1995).

7.2.2.4 Inhalation

No adverse effects were observed in rats dosed with pyrotechnically disseminated TPA (Muse et al. 1995, Thomson et al. 1988).

7.2.2.5 Carcinogenicity/Teratogenicity

Terephthalic acid induces bladder and uretal neoplasms in rats of both sexes when administered at 5% (1000 mg/kg/day) of the diet and induces a high incidence of bladder stones. No tumors or other toxic effects were found. Studies on rats and rabbits found no teratogenic effects (EPA 1982).

7.2.2.6 Wildlife Exposure

An LC_{50} of 36 - 40 mg/L has been calculated for the toad, *Bufo bufo japonicus*. Studies with two fish species, fathead minnows and channel catfish, exposed to radio-labeled di-2-ethylhexyl phthalate indicated that approximately 5% of the total accumulated radioactivity was as phthalic acid (EPA 1982).

7.3 BIDS SIMULANTS

7.3.1 Bacillus Subtilis

7.3.1.1 Physical Structure

Rod shaped microorganism

7.3.1.2 Oral Ingestion

Ingestion of 1.9×10^8 CFU (colony forming units) of *B. subtilis* by rats caused no symptoms of toxicity or infection (EPA 1992b). Studies show *B. subtilis* is not toxic, infective, or pathogenic by oral exposure (EPA 1992b).

7.3.1.3 Dermal Absorption

Humans and animals are exposed to *B. subtilis* found in soil world-wide. Studies show *B. subtilis* is not pathogenic, infective, or toxic to animals by dermal exposure (EPA 1992b). A dose of 3.6 x 10^9 CFU administered to skin of rabbits caused no toxic effects (EPA 1992b). Protease type X-A from *B. subtilis* may cause allergic respiratory and skin reactions. *B. subtilis* may cause infection when contacted via deep tissue wounds, but absorption from skin surface rarely causes infection.

B. subtilis is irritating to mucous membranes and eyes (HMIS. 1994). Slight to severe ocular irritation caused by 0.1 g of *B. subtilis* applied to the eye, dissipated within 1 week (EPA 1992b).

7.3.1.4 Inhalation

Intratracheal administration of 2.84 x 10^8 CFU of *B. subtilis* to rats caused no pathogenic or toxic symptoms (EPA 1992b). *B. subtilis* is identified as a harmless, non-pathogen by the Center for Disease Control and the National Institute of Health. There is no evidence of pathogenicity in healthy adult humans or in animals. It is not thought to be communicable from biota to humans. Exposure to large quantities of aerosolized *B. subtilis* may cause allergic sensitization.

7.3.2 Male Specific Coliphage

7.3.2.1 Physical Structure

polyhedral shaped virus

7.3.2.2 Oral Ingestion

Male Specific Coliphage (MS2) is considered a human non-pathogen. It is fairly common and is encountered in nature on a daily basis. There are no reported incidents of human infection due to exposure to MS2, nor of associated health risks.

7.3.2.3 Dermal Absorption

There are no reported incidents of human infection due to exposure to MS2, nor of associated health risks.

7.3.2.4 Inhalation

There are no reported incidents of human infection due to exposure to MS2, nor of associated health risks.

7.3.2.5 Carcinogenicity/Teratogenicity

There are no reported incidents of human infection due to exposure to MS2, nor of associated health risks.

7.3.3 Erwinea Herbicola

7.3.3.1 Physical Structure

Motile rod shaped microorganism

7.3.3.2 Oral Ingestion

Erwinea herbicola is considered a human non-pathogen. It is encountered in nature on a daily basis. There are no reported incidents of human infection due to exposure to *E. herbicola*, nor of associated health risks.

7.3.3.3 Dermal Absorption

There are few reported incidents of human infection due to dermal exposure to *E. herbicola*. Associated health risk is low. *E. herbicola* may cause infection when contacted via deep tissue wounds, but rarely is infective by absorption from surface of skin.

7.3.3.4 Inhalation

Personnel involved in shredding wood treated by *E. herbicola* may develop mucosal sensitization to associated endotoxins.

7.3.3.5 Carcinogenicity/Teratogenicity

There are no reported incidents of human infection due to exposure to *E. herbicola*, nor of associated health risks.

7.3.4 Ovalbumin

7.3.4.1 Chemical Structure

A single polypeptide chain of about 400 residues, phosphate residues, and a side chain of mannose and glucosamine.

7.3.4.2 Oral Ingestion

There are no reported incidents of toxicity effects due to exposure to ovalbumin, nor of associated health risks.

7.3.4.3 Dermal Absorption

Risk is associated with allergic response especially in organisms sensitive to egg products.

7.3.4.4 Inhalation

Asthma has been reported in workers subjected to repeated exposure to aerosolized egg whites in poultry processing plants (Fine 1990). An aerosol of 11 - 31 mg/m^3 containing 50% protein may cause allergies, especially in non-ventilated situations.

7.3.4.5 Carcinogenicity/Teratogenicity

No information is available about the carcinogenicity/teratogenicity of ovalbumin.

7.3.5 Kaolin Dust

7.3.5.1 Chemical Structure

$H_2Al_2Si_2O_8 \cdot H20$ (approximately)

7.3.5.2 Oral Ingestion

Oral TDLo for a female rat is 590 g/kg over a 37 day test period. Exposure may cause stomach granuloma (USDHHS 1994a). Repeated ingestion of a diet containing 20% kaolin has been associated with anemia and low birth-weight pups in pregnant rats (Patterson and Staszak 1977).

7.3.5.3 Dermal Absorption

Brief contact may cause dermatitis and may be irritating to eyes (Lewis 1992).

7.3.5.4 Inhalation

Kaolin is registered as a nuisance dust. Toxicity depends upon SiO_2 content (Sax 1992). Acute and chronic effects of exposure to kaolin have not been thoroughly studied (HMIS. 1994). Inhalation may cause local irritation of nose, throat, and lungs; short periods of inhalation may cause asthma, edema, and hives (Lewis 1992). Chronic respiration of kaolin may cause chronic bronchitis, pulmonary fibrosis, emphysema, bronchial asthma (Lewis 1992, USDHHS 1994a). The exposure limit established by NIOSH and OSHA is time weighted average (TWA) of 10 mg/m^3 for total dust and TWA of 5 mg/m^3 for the respirable fraction (USDHHS 1994a).

7.3.5.5 Carcinogenicity/Teratogenicity

Kaolin is not classified as a human carcinogen (HMIS 1994, USDHHS 1994a). Currently, no data concerning teratogenicity of ingested or inhaled kaolin are available.

7.4 FOX SIMULANTS

7.4.1 Anisole

7.4.1.1 Chemical Structure

C_7H_8O

7.4.1.2 Oral Ingestion

Anisole is recognized as a safe food additive by the Flavoring Extract Manufacturers' Association and is approved by the FDA for use in foods. Anisole is moderately toxic when ingested in large amounts. In rats and mice, the oral LD_{50} is 3700 mg/kg and 2800 mg/kg, respectively (Aldrich Chemical Co. 1995, Lewis 1992). Ingestion of 50 mg per day for 10 days caused no change or increased liver regeneration in rats (Gershbein 1977).

7.4.1.3 Dermal Absorption

Anisole can be a skin irritant; 500 mg/24 hours applied to rabbits caused moderate irritation (redness and edema) (Lewis 1992). However, two-day application of 4% anisole (in petrolatum) produced no irritation on human skin (Epstien 1976).

7.4.1.4 Inhalation

Inhalation of vaporous anisole is irritating to mucous membranes and upper respiratory tract (Aldrich Chemical Co. 1995). In rats and mice, the LD_{50} for inhaled anisole is > 5000 mg/m^3/3 hours and 3021 mg/m^3/2 hours (Aldrich Chemical Co. 1995).

7.4.1.5 Carcinogenicity/Teratogenicity

Anisole may be mildly tumor promoting. When a 20% solution of anisole in acetone was applied twice weekly to the skin of female mice, 34 of 36 mice survived, but 9% had papillomas and 3% had carcinomas (Boutwell and Bosch 1959).

7.4.2 Benzaldehyde

7.4.2.1 Chemical Structure

C_7H_6O

7.4.2.2 Oral Ingestion

Benzaldehyde is listed by the U.S. Food and Drug Administration as "generally-recognized-as-safe" (USDHHS 1994b). Acute toxicity of benzaldehyde is relatively low. In guinea pigs and rats, the oral LD_{50} is 1000 - 1300 mg/kg (Aldrich Chemical Company. 1995,

HMIS 1994, Lewis 1992, USDHHS 1994b). In mice, the oral LD_{50} is 28 mg/kg (Aldrich Chemical Co. 1995, Lewis 1992). In rats, effects of acute exposure to 800 - 1600 mg/kg/day for 12 days included decrease in weight gain, hyperexcitability, tremors, inactivity, and death (Kluwe et al. 1983). These symptoms were not observed in mice that received similar doses. No gross lesions were detected in rats or mice upon necropsy. In humans, small doses cause central nervous system (CNS) depression (HMIS 1994) while larger doses cause convulsions. A dose of 600 - 900 mg/kg would likely cause death in humans (USDHHS 1994b). The acceptable daily intake (ADI) for humans, established by the Joint Expert Committee on Food Additives, is 0 - 5 mg/kg (USDHHS 1994b).

Toxic effects due to subchronic exposure to benzaldehyde resulted in mice and rats from ingestion of 800 mg/kg/day for 90 days (Kluwe et al. 1983). Symptoms included hyperactivity, trembling, and periodic inactivity. Necropsy revealed toxic lesions in brain, kidney, and forestomach. Necrosis of the cerebellum and hippocampus was found. These lesions were not present in groups of rats exposed to 400 mg/kg/day for 90 days. Considering this study, oral NOEL and LOAEL values were established at 143 mg/kg/day (corrected for chronic exposure) and 400 mg/kg/day, respectively and the RfD is 0.1 mg/kg/day (IRIS 1988). In other studies of effects of chronic (two year) exposure to benzaldehyde, abnormalities of the forestomach were observed, while lesions of kidney and brain did not develop (USDHHS 1994b).

7.4.2.3 Dermal absorption

Benzaldehyde is strongly irritating to human skin and may cause dermatitis (Lewis 1994, Lewis 1992, USDHHS 1994b). However, the compound is also reported to have local anesthetic properties (Lewis 1992). Moderate irritation (redness and edema) occurred within 24 hours following application of 500 mg to skin of rabbits (Lewis 1992).

7.4.2.4 Inhalation

Although benzaldehyde is a volatile compound, no information regarding effects of acute or chronic inhalation of benzaldehyde was found. However, the American Industrial Hygiene Association recommends an 8 hour TWA limit of 8.7 mg/m^3 and a 15 min TWA of 17.4 mg/m^3 (USDHHS 1994b).

7.4.2.5 Carcinogenicity/Teratogenicity

Ingestion of 200 - 400 mg/kg/day produced no evidence of carcinogenic activity in rats. There was limited evidence of carcinogenic activity in mice that received similar doses (USDHHS 1994b). Benzaldehyde has potential antitumor properties, and has been proposed as a chemothereputic agent. Benzaldehyde generally is non-genotoxic, but may produce weak mutagenic effects in some bioassays (USDHHS 1994b). The precautionary label on containers of benzaldehyde states it may cause genetic damage (Aldrich Chemical Co. 1995).

7.4.3 Cyclohexanone

7.4.3.1 Chemical Structure

$C_6H_{10}O$

7.4.3.2 Oral Ingestion

Cyclohexanone is moderately toxic by ingestion. The oral LD_{50} for rats and mice is 1535 mg/kg and 1400 mg/kg, respectively (Lewis 1992, Lijinsky and Kovatch 1986). Other studies report oral LD_{50} for mice as 2.1 g/kg (Gupta et al. 1979, Lijinsky and Kovatch 1986). Symptoms from ingestion of 1.13 - 2.11 g/kg included labored respiration, followed by death (Gupta et al. 1979).

Chronic (2 year) ingestion of 3300 - 6500 ppm cyclohexanone caused considerably reduced weight gain in rats. This effect was observed in mice exposed to 13,000 - 25,000 ppm cyclohexanone (Lijinsky and Kovatch 1986). Considering this study, oral NOAEL and LOAEL of 462 mg/kg/day and 910 mg/kg/day were established, and the oral RfD is 5 mg/kg/day (IRIS 1987). Survival of rats ingesting 25,000 and 13,000 ppm cyclohexane was 50% after one year (Lijinski and Kovatch 1986). In a National Cancer Institute study of subchronic (95 - 175 day) effects, depression of body weight was the only effect observed in rats from ingestion of 7000 ppm cyclohexanone, although increased mortality and body weight depression were observed in mice that ingested 50,000 ppm (IRIS 1987).

7.4.3.3 Dermal Absorption

Cyclohexanone is readily absorbed through skin (Aldrich Chemical Co. 1996). Dermal contact produces skin irritation and can be destructive to mucous membranes. In rabbits, 500 mg applied to open skin produced mild redness and edema. However, dermal LD_{50} was 948 mg/kg (Lewis 1992). The 8 hour TWA for skin exposure to cyclohexanone, as well as the NIOSH exposure limit is 25 ppm (100 mg/m^3) (USDHHS 1994a). The limit for occupational contact established by OSHA is 50 ppm. The IDLH for cyclohexanone is 700 ppm (USDHHS 1994a). Eye contact causes severe irritation. In rabbits, 4740 μg applied to the eye produced severe redness and edema.

7.4.3.4 Inhalation

Cyclohexanone is moderately toxic when inhaled. Inhaled vapors cause respiratory irritation, headache, shortness of breath, and changes in sense of smell (Lewis 1992, USDHHS 1994a). After inhalation of high doses, lungs of mice showed congestion, edema, and hemorrhage (Gupta et al. 1979). In humans, the lowest concentration to cause a toxic effect (TCLo) was 75 ppm, which irritated eyes, nose, and pulmonary system. In rats, LC_{50} was 8000 ppm (Aldrich Chemical Co. 1996, Lewis 1992). Cyclohexanone may have slight narcotic properties and extreme doses may cause coma (USDHHS 1994a). In extreme cases, death may result from spasm, inflammation, and edema of the larynx and bronchi (Aldrich Chemical Co. 1996).

7.4.3.5 Carcinogenicity/Teratogenicity

Currently, cyclohexanone is not classifiable as a human carcinogen and there is no evidence of teratogenic activity of cyclohexanone (IRIS 1987). In rats, 1430 ppm cyclohexanone ingested during gestation days 9 - 16 caused significant depression of maternal and fetal body weight (IRIS 1987). Cyclohexanone was cytotoxic to cultured mouse cells (Gupta et al. 1979) and human mutation has been reported (Lewis 1992).

7.4.3.6 Wildlife Exposure

No information was available about wildlife exposures to cyclohexane.

7.4.4 Diethyl Malonate

7.4.4.1 Chemical Structure

$CH_2(COOC_2H_5)_2$

7.4.4.2 Oral Ingestion

Diethyl malonate is mildly toxic by ingestion. Oral LD_{50} for rats and mice is 15 g /kg and 6400 mg/kg, respectively (Lewis 1992).

7.4.4.3 Dermal Absorption

Dermal contact causes skin irritation. Mild irritation resulted when 500 mg diethyl malonate was applied to skin of rabbit (Lewis 1992).

7.4.4.4 Inhalation

No information was available about the inhalation of diethyl malonate.

7.4.4.5 Carcinogenicity/Teratogenicity

No information was available about the carcinogenicity or teratogenicity of diethyl malonate.

7.4.5 Diethyl Phthalate

7.4.5.1 Chemical Structure

$C_6H_4(CO_2C_2H_5)_2$

7.4.5.2 Oral Ingestion

Diethyl phthalate is moderately toxic by ingestion. Rats fed diets containing 5% diethyl phthalate (approx. 3160 mg/kg/day in males and 3710 mg/kg/day in females) had significantly lower weight gain, and lower absolute weight of heart, brain, liver, spleen, and kidneys (IRIS 1993). However, relative weights of these and other organs were significantly greater in test animals than control animals (Brown et al. 1978). Females fed diets with 1% diethyl phthalate (750 mg/kg/day) also had significantly less weight gain (IRIS 1993).

Chronic intake may cause sluggishness, loss of strength, weight loss, and paralysis of hind quarters (HMIS 1994, J.T. Baker Inc. 1989a). Ingestion of 3250 mg/kg/day of diethyl phthalate by parent rats produced physiological effects in pups (F_1) and significantly decreased number of pups in second-generation litters (F_2). Physiological effects included significant decrease in body weight and increased weight of prostate, liver, and pituitary. The significance of organ weight differences is not fully understood (USDHHS 1993).

The oral NOAEL and LOAEL were established at 750 mg/kg/day and 3160 mg/kg/day, respectively. The lowest reported NOAEL value for diethyl phthalate is 1000 mg/kg/day (USDHHS 1993). The oral RfD is 0.8 mg/kg/day (IRIS 1993). The oral LD_{50} in rats and guinea pigs is 8600 mg/kg, while the LD_{50} in mice is 6172 mg/kg (HMIS 1994, J.T. a 1989, Lewis 1992). Ambient water criteria for diethyl phthalate limits intakes through contaminated water and organisms to 350 mg/L, and through organisms alone to 1.8 g/L (EPA 1986).

7.4.5.3 Dermal Absorption

Diethyl phthalate is only slightly irritating when applied to intact or abraded skin. Mild irritation occurred when diethyl phthalate was applied to the eyes of rabbits (USDHHS 1993). A NOAEL of 0.1 mL was established for rabbits (USDHHS 1993). In vitro tests of diethyl phthalate show the chemical is absorbed more quickly through rat skin than human skin.

7.4.5.4 Inhalation

Diethyl phthalate causes irritation when inhaled. Few studies regarding effects from inhalation exposure to humans or animals have been located. The lowest dose of diethyl phthalate vapor to cause an effect in humans was 1000 mg/m^3, which caused lachrimation, respiratory obstruction, and other pulmonary effects (Lewis 1992). Other symptoms include CNS depression, coughing, and difficulty breathing (HMIS 1994). The OSHA (PEL) value and the ACGIH (TLV) value is a TWA of 5 mg/m^3. No NOAEL values for inhalation were reported in the Toxicological Profile of Diethyl phthalate.

7.4.5.5 Carcinogenicity/Teratogenicity

No information was available about the carcinogenicity or teratogenicity of diethyl phthalate.

7.4.5.6 Wildlife Exposure

Fish, algae, fungi, and bacteria and other microorganisms are able to degrade phthalates to more simple molecules (Woodward 1986). Phthalate esters concentrate in fish tissues, but concentrations decline rapidly when the chemical is removed from water. In two species of minnow under static conditions, there was no observable effect after 96 hours with a concentration of 22 - 30 mg/L diethyl phthalate (Woodward 1986). The LC_{50} for these minnows was 17 - 30 mg/L. It is unlikely that levels or diethyl phthalate normally present in the environment adversely affect on mammals (Woodward 1986). Accumulation in biota likely is not a hazard to predatory birds (Woodward 1986).

7.4.6 Dimethyl Phthalate

7.4.6.1 Chemical Structure

$C_6H_4(COOH_3)_2$

7.4.6.2 Oral Ingestion

Dimethyl phthalate is moderately toxic by ingestion. The oral LD_{50} for rats and mice is 6800 mg/kg, for rabbits 4400 mg/kg, for guinea pigs 2400 mg/kg, and for chickens 8500 mg/kg (Aldrich Chemical Co. 1995b, Lewis 1992). The oral NOEL reported by IRIS was 1000 mg/kg/day based upon chronic study of rats showing effects to kidneys. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, headache, nausea, and vomiting (Aldrich Chemical Co. 1995b). Intake of dimethyl phthalate may cause CNS depression (Aldrich Chemical Co. 1995b, J.T. Baker Inc. 1992a). The subchronic RfD is 100 mg/kg/day (EPA 1993). Ambient water criteria for dimethyl phthalate limits intakes through contaminated water and organisms to 313 mg/L, and through organisms alone to 2.9 g/L (EPA 1986).

7.4.6.3 Dermal Absorption

Dimethyl phthalate causes irritation when applied to eyes (Lewis 1992, USDHHS 1994). The LD_{50} for dermal exposure to dimethyl phthalate in rats, rabbits, and guinea pigs is > 4800 mg/kg, > 20 mL/kg, and > 10 mL/kg, respectively (Aldrich Chemical Co. 1995b).

7.4.6.4 Inhalation

Dimethyl phthalate is mildly toxic by inhalation. The LCLo, established in cats, was 930 mg/m^3/6 hours (Lewis 1992). Symptoms may include irritation of upper respiratory system and mucous membranes (Aldrich Chemical Co. 1995b, J.T. Baker Inc. 1992a, USDHHS 1994). Occupational exposure limits reported by OSHA (PEL) and ACGIH (TLV) are TWA of 5 mg/m^3. The IDLH is 2000 mg/m^3 (USDHHS 1994). No information regarding inhalation of dimethyl phthalate was available from IRIS.

7.4.6.5 Carcinogenicity/Teratogenicity

Dimethyl phthalate caused mutagenic effects *in vitro* bioassays (IRIS 1993). It may be toxic to embryos and affect development of fetal eye, ear, and musculoskeletal tissues (Aldrich Chemical Co. 1995b).

7.4.6.6 Wildlife Exposure

No information regarding wildlife exposures to dimethyl phthalate is available.

7.4.7 Ethyl Phthalate

7.4.7.1 Chemical Structure

$C_6H_4(CO_2CH_2CH_3)_2$

7.4.7.2 Oral Ingestion

Ethyl phthalate is moderately toxic by ingestion (IRIS 1993) (see diethyl phthalate).

7.4.7.3 Dermal Absorption

Ethyl phthalate is only slightly irritating when applied to intact or abraded skin (see diethyl phthalate) (USDHHS 1993).

7.4.7.4 Inhalation

Ethyl phthalate causes irritation when inhaled (Lewis 1992). Few studies regarding effects from inhalation exposure to humans or animals are available (see diethyl phthalate).

7.4.7.5 Carcinogenicity/Teratogenicity

Ethyl phthalate caused mutagenic effects *in vitro* bioassays (IRIS 1993).

7.4.7.6 Wildlife Exposure

No information regarding wildlife exposures to ethyl phthalate is available.

7.4.8 Eucalyptol

7.4.8.1 Chemical Structure

$C_{10}H_{18}O$

7.4.8.2 Oral Ingestion

Eucalyptus oil, containing chiefly eucalyptol, is a human poison when ingested in large amounts. In a human child, 218 mg/kg caused ciliary eye spasms, respiratory depression, and somnolence. In an adult human, 375 mg/kg was lethal. The LD_{50} in rats is 2480 mg/kg (Lewis 1992). Ingestion of non-toxic amounts of eucalyptol, along with other terpenes, has been shown to reduce activity of hepatic coenzymes, which may inhibit formation of gallstones (Clegg et al. 1980).

7.4.8.3 Dermal Absorption

Eucalyptus oil caused moderate skin irritation when applied to rabbits (Lewis 1992).

7.4.8.4 Inhalation

No information regarding inhalation of eucalyptol is available.

7.4.8.5 Carcinogenicity/Teratogenicity

No information was available regarding the carcinogenicity of eucalyptol. Eucalyptol is able to pass through the placenta; to the fetus, eucalyptol may stimulate liver microsomal activity (Jori and Briatico 1973). Eucalyptol is not able to cross the blood-milk barrier from mother to nursing young (Jori and Briatico 1973).

7.4.8.6 Wildlife Exposure

No information regarding wildlife exposures to eucalyptol is available.

7.4.9 Methyl Salicylate

7.4.9.1 Chemical Structure

$C_8H_8O_3$

7.4.9.2 Oral Ingestion

Methyl salicylate is recognized as a safe food additive by the FDA (Bennett et al. 1984). Chemical exposure via ingestion poses the biggest threat to humans and animals. Effects include dyspnea, nausea, vomiting, and excitation of the CNS (J.T. Baker 1989b, Lewis 1992, Opdyke 1979). Oral administration of 700 mg/kg in dogs decreased cardiac output and increased heart rate (Opdyke 1979). Large doses (> 600 mg/kg) affected the CNS and respiratory function. In rats the oral LD_{50} is 887 mg/kg and the oral TDLo is 36,450 mg/kg (Lewis 1992). Human ingestion of small doses (30 mL for adults) may cause death (Bennett et al. 1984, Lewis 1992, Opdyke 1979).

Chronic intake of methyl salicylate may cause damage to liver, kidneys, and blood (J.T. Baker Inc. 1989b). One study showed ingestion of methyl salicylate as 1% - 2% of the diet for two years caused significant decrease in body weight and may change bone composition. The highest dose caused death in 50 days (Opdyke 1979). Dogs receiving > 500 mg/kg/day decreased in body weight and died by day 59. In rats, two years' consumption of 0.21% methyl salicylate in the diet caused no adverse effects (Opdyke 1979).

7.4.9.3 Dermal Absorption

Dermal application of methyl salicylate can cause skin and eye irritation and repeated application has been known to cause kidney damage among laboratory animals (HMIS 1994). The acute dermal LD_{50} in rabbits exceeds 5 g/kg (Opdyke 1979). In rabbits, 500 mg applied to skin caused moderate redness and edema and the same amount applied to eyes caused mild to severe redness (Lewis 1992).

7.4.9.4 Inhalation

Rats exposed 20 times to 700 mg/m^3 methyl salicylate for 7 hours caused no toxic symptoms or pathologic abnormalities (Opdyke 1979).

7.4.9.5 Carcinogenicity/Teratogenicity

Methyl salicylate is not known to be carcinogenic (Opdyke 1979, HMIS 1994). Injection of 0.1 mL methyl salicylate to female rats in day 10 and 11 of pregnancy decreased weight gain of the mother, decreased number and weight of young, increased number of malformed young and resorptions, and retarded renal development in rat fetuses (Opdyke 1979). Up to 5000 ppm methyl salicylate administered to rats for 3 generations did not decrease fertility, but 3000 - 5000 ppm doses decreased litter size, survival, and numbers of live-born progeny (Opdyke 1979). In a separate study, effects to offspring were observed in rats ingesting 36,540 mg/kg methyl salicylate (Bennett et al. 1984).

7.4.10 Sodium Carbonate (a Chemical Constituent of Soman, PCAS)

7.4.10.1 Chemical Structure

$CO_3 \cdot 2Na$

7.4.10.2 Oral Ingestion

Sodium carbonate is moderately toxic by ingestion with a rat oral LD_{50} of 4090 mg/kg (Lewis 1992). Ingestion of large quantities may corrode the GI tract, and cause vomiting and diarrhea (HSDB 1987).

7.4.10.3 Dermal Absorption

Sodium carbonate is a mild skin and eye irritant (HSDB 1987, Lewis 1992). An aqueous solution of 50% weight/volume sodium carbonate applied to abraded and intact skins of rabbits and guinea pigs caused little or no redness or swelling after 48 hours (HSDB 1987).

7.4.10.4 Inhalation

Sodium carbonate is moderately toxic with a LC_{50} of 2300 mg/m^3/2 hours (Lewis 1992). Rats exposed to an aerosol of 2% aqueous solution of sodium carbonate for 4 hours/day, 5 days/week for 3.5 months had reduced weight gain and lung damage (HSDB 1987).

7.4.10.5 Carcinogenicity/Teratogenicity

No information is available regarding carcinogenic or teratogenic effects.

7.4.11 Polyethylene oxide (a Chemical Constituent of Soman, PCAS)

7.4.11.1 Chemical Structure

Chain of ethylene oxide $[CH_2CH_2O]_nH$

7.4.11.2 Oral Ingestion

Ethylene oxide is a poison by ingestion (Lewis 1992).

7.4.11.3 Dermal Absorption

Ethylene oxide is an irritant to skin and eyes as well as mucous membranes of the respiratory tract.

7.4.11.4 Inhalation

Ethylene oxide is moderately toxic by inhalation with a rat LC_{50} of 800 ppm/4 hours. Human systemic effects by inhalation include convulsions, nausea, vomiting, and olfactory and pulmonary changes (Lewis 1992). High concentrations can cause pulmonary edema (Lewis 1992).

7.4.11.5 Carcinogenicity/Teratogenicity

Ethylene oxide is a confirmed human carcinogen with experimental carcinogenic, tumerigenic, neoplastigenic, and teratogenic study results (Lewis 1992).

7.4.11.6 Wildlife Exposure

Information on wildlife exposures to ethylene oxide is not available.

7.4.12 Hydroxyethylcellulose (a Chemical Constituent of Soman, PCAS)

7.4.12.1 Chemical Structure

$[C_6H_7O_2(OH)_3]_n$

7.4.12.2 Oral Ingestion

The greatest danger from ingestion of large quantities is intestinal obstruction. Toxic doses by ingestion are in excess of 2 g/kg. Groups of rats maintained for 2 years on diets containing 5%, 1%, and 0.2% hydroxyethylcellulose did not exhibit adverse effects to growth, food intake, life-span, frequency of extraneous infections, body measurements, kidney and liver weights, hematologic exam, occurrence of neoplasms, or histologic exams of organs. It has been administered to rats in single oral doses as high as 23,000 mg/kg with no toxic effects (HSDB 1987).

7.4.12.3 Dermal Absorption

Skin sensitization is unusual (HSDB 1987).

7.4.12.4 Inhalation

Inhalation could cause chemical pneumonitis.

7.4.12.5 Carcinogenicity/Teratogenicity

Hydroxyethylcellulose is not a risk to human or animal health. It is not toxic or carcinogenic (Scientific Polymer Products Inc. 1994).

7.4.13 Glycerol (a Chemical Constituent of Soman, PCAS)

7.4.13.1 Chemical Structure

$C_3H_5(OH)_3$

7.4.13.2 Oral Ingestion

Glycerol has low oral toxicity in humans (IRIS). Very high concentrations may cause damage to kidneys and red blood cells (IRIS). Toxic effects including headache, nausea, and vomiting occurred in an adult human after ingestion of 1428 mg/kg glycerol (Lewis 1992, HMIS 1994). The oral LD_{50} in mice and guinea pigs is 4090 mg/kg and 7750 mg/kg, respectively (Lewis 1992). The oral LD_{50} in rats is 12,600 mg/kg (HMIS 1994). Chronic ingestion may cause damage to kidneys (HMIS 1994).

7.4.13.3 Dermal Absorption

Glycerol has a low irritant potential to human skin and eyes (IRIS). Glycerol application caused sensitization in a few individuals (IRIS, HMIS 1994). Application of 500 mg/24 hours caused mild redness and edema in rabbits (Lewis 1992). Contact of 500 mg/24 hours with rabbit eyes caused mild of irritation (Lewis 1992).

7.4.13.4 Inhalation

In humans, glycerol is a nuisance particle and an inhalation irritant (Lewis 1992). Occupational exposure limits established for glycerol mist by OSHA (PEL) and ACGIH (TLV) are TWA 10 mg/m^3 (Lewis 1992).

7.4.13.5 Carcinogenicity/Teratogenicity

Human mutation data have been reported (Lewis 1992). However, there is no evidence of carcinogenicity in long-term oral and dermal absorption studies of rats (IRIS). Most tests for mutagenicity were negative (IRIS).

No information regarding wildlife exposure to glycerol is available.

7.4.14 Diethyl Malonate (a Chemical Constituent of Soman, PCAS)

Please refer to section 7.4.4 for information regarding diethyl malonate.

7.4.15 Ferrous Ammonium Sulfate (a Chemical Constituent of Mustard Lewisite, PCAS)

7.4.15.1 Chemical Structure

No chemical structure of ferrous ammonium sulfate is available.

7.4.15.2 Oral Ingestion

Ferrous ammonium sulfate is poorly absorbed from the gastrointestinal tract. Ingestion causes irritation of the mouth and stomach (HSDB 1995). Ingestion of large amounts of ammonium salts is toxic and may cause abdominal pain, diarrhea, vomiting, lassitude, hyperventilation, corrosion of the stomach, and cardiovascular collapse (HSDB 1995). The lethal dose is related to iron content; as little as 1 - 2 g of iron may cause death. In rats, the LD_{50} is 0.5 - 5 g/kg (HSDB 1995).

7.4.15.3 Dermal Absorption

Dust can irritate skin and eyes with prolonged contact (HSDB 1995).

7.4.15.4 Inhalation

Inhalation of dust irritates the nose and throat. The exposure standard recommended by OSHA is an 8 hour TWA of 1 mg/m^3 (HSDB 1995).

7.4.15.5 Carcinogenicity/Teratogenicity

No information was found about carcinogenicity or teratogenicity. Iron is known to cross the placenta and may concentrate in the fetus (HSDB 1995).

7.4.15.6 Wildlife Exposure

No information regarding wildlife exposure to ferrous ammonium sulfate is available.

7.4.16 Polyethylene oxide (a Chemical Constituent of Mustard Lewisite, PCAS)

Please refer to section 7.4.11 for information regarding polyethylene oxide.

7.4.17 Hydroxyethylcellulose (a Chemical Constituent of Mustard Lewisite, PCAS)

Please refer to section 7.4.12 for information regarding hydroxyethylcellulose.

7.4.18 Glycerol (a Chemical Constituent of Mustard Lewisite, PCAS)

Please refer to section 7.4.13 for information regarding glycerol.

7.4.19 Methyl salicylate (a Chemical Constituent of Mustard Lewisite, PCAS)

Please refer to section 7.4.9 for information regarding methyl salicylate.

7.4.20 2,2 Dipyridyl (a Chemical Constituent of CADS, PCAS)

7.4.20.1 Chemical Structure

$C_{10}H_8N_2$

7.4.20.2 Oral Ingestion

Dipyridyl administered orally to rats caused tremors and slight ptosis that completely disappeared in 24 hours (HSDB 1995).

7.4.20.3 Dermal Absorption

Dipyridyl caused conjunctivitis and alopecia with dermal contact (HSDB 1995).

7.4.20.4 Inhalation

No information regarding inhalation of 2,2 dipyridyl is available.

7.4.20.5 Carcinogenicity/Teratogenicity

Genotoxic effects to mammalian cells have been shown in *in vitro* assays. Effects included damage to DNA and mutagenic effects (Kuo and Lin 1993). When rats were given a single dose of 60 or 75 mg/kg, fetuses were low in weight and had limb defects (Oohira and Nogami 1978).

7.4.20.6 Wildlife Exposure

No information regarding wildlife exposure to 2,2 dipyridyl is available.

7.4.21 Phenolphthalein (a Chemical Constituent of CADS, PCAS)

7.4.21.1 Chemical Structure

$C_{20}H_{14}O_4$

7.4.21.2 Oral Ingestion

Phenolphthalein is most commonly absorbed into the body by ingestion. In humans, it is toxic only via intraperitoneal exposure (Lewis 1992). In a 13-week experiment with rats, exposure to phenolphthalein, at doses much higher than normally encountered, produced little evidence of toxicity in rats (Dietz et al. 1992). However, elevated liver and kidney weights did occur. Reproductive changes also resulted. Side effects included depressed testis and sperm densities, increases in abnormal sperm production, and morphological changes in seminiferous tubules (Dietz et al. 1992). Changes occurred between exposure quantities of 3000 ppm to 50,000 ppm (Dietz et al. 1992). In rats the peritoneal LDLo is 500 mg/kg (Lewis 1992).

7.4.21.3 Dermal Absorption

Exposure to phenolphthalein caused edema of eyelids and accompanying reactions of the skin, some of which were severe (HSDB 1995).

7.4.21.4 Inhalation

Phenolphthalein can also create a health risk to humans and animals during thermal decomposition. Thermal decomposition emits acrid smoke and irritating fumes (Dietz et al. 1992, Lewis 1992).

7.4.21.5 Carcinogenicity/Teratogenicity

No data were found regarding the carcinogenic effects of phenolphthalein exposure. However, experiments, data, and information reviewed did not mention carcinogenic effects.

Teratogenic effects are limited to a few reproductive side effects. Phenolphthalein fed to mice for 3 generations failed to produce teratogenesis (HSDB 1995). Ingestion of phenolphthalein by pregnant mice caused significant reduction in fertility and number of litters (Gulati et al. 1991).

7.4.21.6 Wildlife Exposure

No information regarding wildlife exposure to phenolphthalein is available.

7.4.22 Isopropanol (a Chemical Constituent of CADS, PCAS)

7.4.22.1 Chemical Structure

$(CH_3)_2CHOH$

7.4.22.2 Oral Ingestion

Ingestion of isopropyl alcohol in humans may produce gastrointestinal pain, cramps, nausea, and vomiting. Extreme concentrations result in coma, shock, respiratory failure, and death (J.T. Baker Inc. 1990, Lewis 1992, NIOSH 1976, HMIS 1994). Small doses (2.6 mg/kg to 6.4 mg/kg) produced no adverse effects among adult human males. In juvenile rats, the oral LD_{50} is 5.6 mL/kg; in adult rats the oral LD_{50} is 6.8 - 6.0 mL/kg (HMIS 1994, NIOSH 1976). The oral LD_{50} reported for rabbits is 10.2 mL/kg (HMIS 1994).

7.4.22.3 Dermal Absorption

Isopropyl alcohol is not a strong dermal irritant and rarely causes contact dermatitis. Acute dermal LD_{50} in rabbits was 16.4 mL/kg (NIOSH 1976). Isopropyl alcohol failed to produce adverse effects when applied dermally to guinea pigs, dogs, and white rats (no dosage given) (NIOSH 1976). Contact with eyes may cause damage and severe corneal burns (HMIS 1994).

7.4.22.4 Inhalation

Isopropyl alcohol vapors may cause irritation of eyes, nose, and throat. Inhalation of high concentrations causes narcosis (J.T. Baker Inc. 1990, Lewis 1992, NIOSH 1976, HMIS 1994). In rats, the maximum average daily concentration of isopropyl alcohol that caused no

adverse effects was 0.6 mg/m^3 (0.24 ppm; NIOSH 1976). Rats that inhaled more than 1 ppm continuously for 86 days exhibited slowed reaction times, significant changes in blood chemistry, and cellular damage of the spleen, liver, and cerebral motor neurons (NIOSH 1976). Exposure limits established by OSHA and NIOSH are 400 ppm (980 mg/m3) and 500 ppm for short term exposure. The IDLH is 2000 mg/m^3 (USDHHS 1994a).

7.4.22.5 Carcinogenicity/Teratogenicity

There is no evidence isopropyl alcohol is carcinogenic (HMIS 1994, NIOSH 1976, Lewis 1992). Currently, no data concerning teratogenicity of ingested or inhaled isopropyl alcohol are available.

7.5 NON SPECIFIC SIMULANTS

7.5.1 Titanium Dioxide (Hand Grenade Smoke Simulating Brass Obscurant)

7.5.1.1 Chemical Structure

TiO_2

7.5.1.2 Oral Ingestion

Generally, titanium compounds (specifically titanium dioxide) are considered physiologically inert, and are not toxic by ingestion (Lewis 1992). Titanium is not absorbed from the gastrointestinal tract by blood (HSDB 1995). In rats fed titanium coated mica as 1% - 5% of the diet for up to 130 weeks, there was no evidence of a toxicological effect (HSDB 1995).

7.5.1.3 Dermal Absorption

Titanium dioxide is not known to produce contact dermatitis or allergic sensitization, but it may be irritating to human skin (HSDB 1995, Lewis 1992).

7.5.1.4 Inhalation

Titanium dioxide is a nuisance dust (HSDB 1995). It is a mild pulmonary irritant and may be responsible for episodes of bronchitis and lung damage in industrial situations (HSDB

1995). Most inhaled titanium dioxide is biologically inert (HSDB 1995). Rats that inhaled 10, 50, or 250 mg/m^3 titanium dioxide for 6 hours/day, 5 days/week, for 104 weeks had no significant effects to tissues, weight gain, or survival (HSDB 1995). Lung tumors were found in rats exposed to 250 mg/m^3 for 24 months (HSDB 1995). In a separate study with identical exposure criteria, rats exposed to 250 mg/m^3 had marked increase in weight of lungs and lung macrophages. After two years' exposure, some lung cancers were observed (HSDB 1995).

7.5.1.5 Carcinogenicity/Teratogenicity

Titanium dioxide is not classifiable as to carcinogenicity in humans (HSDB 1995). There are experimental carcinogenic, tumerogenic, and neoplastinogenic data for titanium dioxide (Lewis 1992). In rats fed titanium coated mica as 1% - 5% of the diet for up to 130 weeks, there was no evidence of carcinogenic effects (HSDB 1995).

7.5.1.6 Wildlife Exposure

There were no apparent toxic effects in *Daphnia magna* that were exposed to 1000 mg/L titanium dioxide (Haley and Kurnas 1993).

7.5.2 PEG 200-Polyethylene glycol

7.5.2.1 Chemical Structure

$(-CH_2CH_2O-)_n$, where $n \geq 4$. In general, each PEG is followed by a number indicating its general molecular weight, (200 in this case)

7.5.2.2 Oral Ingestion

Polyethylene glycol (PEG) is practically non-toxic, however low molecular weight PEGs have the most toxic effects (HSDB 1995). Polyethylene glycols caused no adverse effects in dogs when fed for one year at 2% of their diet (HSDB 1995). PEG is classified as safe for use in food. The oral LD_{50} in rats and mice was 28,900 mg/kg and 38,300 mg/kg, respectively. The oral LD_{50} for rabbits and guinea pigs is 19.9 g/kg and 17 g/kg, respectively (Dickie 1979). Rats that ingested 16 g/kg/day of PEG in drinking water for 15 days had severe kidney abnormalities (Dickie 1979). Some rats ingesting PEG 200 at 8 - 20 g/kg/day for 80 - 90 days

died of liver and kidney abnormalities, but survivors in these studies had nearly normal organs (Dickie 1979). A dose of 5 g/kg/day for 90 days in drinking water caused no effects to rats.

7.5.2.3. Dermal Absorption

No toxic effects caused by dermal contact have been documented. Application of 2 mL/kg PEG on rabbit skin caused no deaths. Administration of 0.1 mL to the rabbit eye caused no irritation. Application of 50% PEG on human skin caused no irritation to diseased or normal skin (HSDB 1995).

7.5.2.4 Inhalation

No TWA or TLV values have been established for polyethylene glycol. Inhalation of this compound does not present a significant exposure because of extremely low vapor pressure. In mice and rats, acute inhalation of 2516 mg/m^3 (6 hours) caused no deaths or "biologically sufficient" effects. Chronic inhalation of 1000 mg/m^3 (13 weeks) caused no deaths or "biologically sufficient" effects.

7.5.2.5 Carcinogenicity/Teratogenicity

No carcinogenic effects have been documented in relation to PEG 200. There were no teratogenic effects in pregnant rats fed doses of 10 gm/kg/day of PEG for 10 days. Other studies confirmed these results (HSDB 1995). However, teratogenic activity of PEG 200 in mice has been demonstrated in laboratory tests, and the occurrence of severe facial malformations has been reported (HSDB 1995). Another study reported abnormal brain development as the main effect in mice. Polyethylene glycol 200 proved embryolethal at 0.5% and 0.75% in rats, hamsters, rabbits, and humans. The concentration of PEG 200 at 1% is embryolethal (HSDB 1995).

7.6 SELECTION OF TOXICITY VALUES

Toxicity values were selected from Table 10, which identifies toxicity values for each chemical stressor evaluated in the ERA. We derived toxicity values when specific values were not available for Indiana bats, gray bats, and bald eagles.

Several methods exist to establish a toxicity value. A value for the species in the same taxonomic family (preferentially) is used to estimate a toxicity value for the species of concern. This approach is considered scientifically justified (California Dept. of Toxic Substances Control 1994). Species chosen from which to develop toxicity data are termed surrogate species. Selection of appropriate toxicity values, based on a balance of taxonomic and physiological similarity, quality of data, and expected mode of toxic action is recommended by the State of California Department of Toxic Substances Control (1994). Toxicity values of surrogate species can be used to estimate toxicity values for the representative species. Data from surrogate species could be used to estimate the NOAEL in the representative species. The NOAEL (surrogate) may be adjusted by dividing by uncertainty factors (UF) to determine a relative value for the species of concern. UFs are commonly applied to animal toxicity data values to establish human toxicity values. RfD's, as described earlier, are established by this method. RfD's are not available for animals.

We developed toxicity values for Indiana bats, gray bats, and bald eagles by two methods. We developed a model (BATS.XLS) for the Ongoing Mission BA (3D/Environmental 1996b) employing allometric equations to extrapolate toxicity values from common test species (e.g. rats, guinea pigs, and mice) to toxicity values for Indiana bats and gray bats. BATS.XLS compares weights and body size of the test species (surrogate) and species of concern. This method assumes the species of concern is as sensitive to the stressor as the surrogate species. We used the calculated NOAEL for inhalation and ingestion ($NOAEL_{air}$ and $NOAEL_{food}$) of Indiana bats and gray bats for terephthalic acid (refer to Ongoing Mission BA for more details about this model) because we could not find NOAEL values for most of the stressors. This method does not account for significant differences in anatomy or physiology. BATS.XLS was created to provide modeled toxicity values for Indiana bats and gray bats. We did not include information to extrapolate bald eagle toxicity values. Avian toxicity values were not readily available.

We established a TRV for TPA for bald eagles. We used the same decision process for the development of Toxicity Reference Values (TRVs) for Indiana bats and gray bats for all stressors except TPA. TRV's were developed by selecting toxicity values from Table 10 for the chemical stressors. Next, we applied uncertainty factors presented in Wentsel et al. (1994). Table 11 provides the "critical study" for each toxicity value. Figure 10 is the decision tree with

UFs indicated. UFs are multiplicative and are used to express degrees of uncertainty. The toxicity value (i.e. NOAEL or LD_{50}) is divided by the appropriate UFs.

We used a hierarchy for selection of toxicity values. Toxicity values were selected in the following order chronic NOAEL, chronic LOAEL, acute NOAEL, acute LOAEL, LD50 or LC50, PEL, and TLV. Table 11 presents the toxicity values selected with appropriate UFs (Figure 10) for the TRV. TRVs were calculated for bats (both species) and bald eagles. Indiana and gray bats were not treated differently in this method because they belong to the same genera. BATS.XLS treats these two species differently due to different body weights and sizes.

We established one dermal TRV for fog oil. It was the only dermal toxicity value identified in the toxicity assessment. We did not determine if UFs (established by Wentsel et al. 1994) we applied account for differences in dermal toxicity between surrogate species and species of concern. Without establishing another UF, we chose to use the same UFs as ingestion and inhalation. This assumes the toxic responses expressed by a rat would be similar to those in bats and birds. UFs applied would account for some differences in sensitivity.

TABLE 10. Toxicity values of chemical gathered during the literature search. Values used in the ERA are shaded.

Chemical	Value and Source
Fog Oil (acute)	(Shinn et al. 1987)
LC50 acute rat ihl	60000 mg/m3
Diesel Fuel	(Shinn et al. 1987)
LC50 rat ihl	26000 mg/m3
Fog Oil	(Selgrade et al. 1990)
LC50 rat ihl	2.0 mg/l
SGF-2 aerosols	(Driver et al. 1992)
LC50 acute ihl rat	5200 mg/m3
Old Fog Oil (acute)	(Driver et al. 1992)
Dermal LD50 rat	>2g/kg (effect at dose was slight skin irritation = LOAEL)
Oral LD50 rat	>5g/kg
Paraffinic lube oil (acute)	(Driver et al. 1992)
Dermal LD50 rat	>2g/kg (effect at dose was slight skin irritation = LOAEL)
Oral LD50 rat	>5g/kg
Napthenic Fog Oil (acute)	(Driver et al. 1992)
Dermal LD50 rat	>2g/kg (effect at dose was slight skin irritation = LOAEL)
Oral LD50 rat	>5g/kg
Fog Oil	(Driver et al. 1992)
ACGIH TWA	5 mg/m3
ACGIH STEL	10 mg/m3
Fog Oil	(Palmer et al. 1992)
Chronic LOAEL	100 mg/m3
Fog Oil	(Driver et al. 1992)
NOAEL (animal study)	5 mg/m3
Light Mineral Oil	(Driver et al. 1992)
NOAEL dog,rat,mus,rbt,ham	5mg/m3
LOAEL dog,rat,mus,rbt,ham	100 mg/m3
Light Mineral Oil	(Lewis 1989)
LD_{50} mus, orl, chronic	22 g/kg
TD_{lo} rat, dermal, acute	216 g/kg
Mineral Oil	(Bramachari 1958)
LOAEL rat, orl, acute	17.6 g/kg
Old Fog Oil	(Driver et al. 1992)
LOAEL rat	200 mg/m3
Auto Lube Oil	(Driver et al. 1992)
LOAEL mouse	
Diesel Fuel	(Driver et al. 1992)
LD50 rat	16.0 ml/kg
Aromatic distillate	(Driver et al. 1992)
LD50 rat	4600 mg/m3 (7 hours)
Terephthalic Acid	(EPA 1982)
LD50 mice ipl	1900 mg/kg
LD100 mice ipl	3200 mg/kg
LD100 dogs inv	2mg/kg/min

Chemical	Value and Source
TPA	(ACGIH 1995)
TWA Human	10 mg/m^3
Bacillus subtillus (bpn)	(Lewis 1992)
LD50 ipr mus	75 mg/kg
Bacillus subtillus (carlsburg)	(Lewis 1992)
LD50 orl rat	3700 mg/kg
M2 Coliphage	Non-toxic
Erwinia herbicola	Non-toxic
Ovalbumin	Non-toxic
Kaolin dust	(HMIS 1994)
OSHA PEL	10 mg/m3
ACGIH TLV	2 mg/m3
Kaolin dust	(Lewis 1992)
orl rat TDlo	590 g/kg
Anisole	(Lewis 1992)
skn rbt	500 mg (24 hours MOD)
orl rat LD50	3700 mg/kg
orl mus LD50	2800 mg/kg
Anisole	(Opdyke 1974)
Acute oral LD50 mus	2800 mg/kg
Acute oral LD50 rat	3700 mg/kg
Anisole	(Aldrich 1995)
orl rat LD50	3700 mg/kg
ihl rat LC50	>5000 mg/m3
orl mus LD50	2800 mg/kg
ihl mus LC50	3021 mg/m3/2H
Anisole	(Taylor 1964)
LD50 rat	3700 mg/kg
Benzaldehyde	IRIS 1995
NOEL	200 mg/kg/day converted to 143 mg/kg/day
LOAEL	400 mg/kg/day
RfD	1E-1 mg/kg/day
Benzaldehyde	(Lewis 1992)
skn rbt	500 mg (24 hours MOD)
orl rat LD50	1300 mg/kg
scu rat LDlo	5000 mg/kg
orl mus LD50	28 mg/kg
ipr mus LD50	9 mg/kg
scu rbt LD50	5000 mg/kg
orl gpg LD50	1000 mg/kg
Benzaldehyde	(Kluwe et a. 1983)
NOEL rat	400 mg/kg/day
NOEL Male Mouse	300 mg/kg/day
NOEL Female Mouse	600 - 1200 mg/kg/day
Benzaldehyde	(HMIS 1994)
orl rat LD50	1300 mg/kg

Chemical	Value and Source
Benzaldehyde	(Aldrich Chemical Company 1995)
orl rat LD50	1300 mg/kg
orl mus LD50	28 mg/kg
ipr mus LD50	9 mg/kg
ocu rbt LD50	5 gm/kg
orl gpg LD50	1 gm/kg
orl mam LD50	2020 mg/kg
Cyclohexanone	(IRIS 1995)
NOAEL	3300 ppm (462 mg/kg/day)
LOAEL	6500 ppm(910 mg/kg/day)
RfDo	5E+0 mg/kg/day
Cyclohexanone	(Lijinsky and Kovatch 1986)
orl rat LD50	1.6 g/kg
orl mus LD50	2.1 g/kg
Cyclohexanone	(Lewis 1992)
orl rat LD50	1535 mg/kg
inhl rat LC50	8000 ppm (4 hours)
scu rat LD50	2170 mg/kg
orl mus LD50	1400 mg/kg
ipr mus LD50	1350 mg/kg
sku mus LDlo	1300 mg/kg
ivn dog LDlo	630 mg/kg
orl rbt LDlo	1600 mg/kg
skn rbt LD50	948 mg/kg
Cyclohexanone	(HMIS 1994)
OSHA PEL	S, 50 ppm
ACGIH TLV	S, 100ppm (Skin) STEL
LD50 orl rat	1620 mg/kg
Cyclohexanone	(Aldrich Chemical Company
orl rat LD50	1620 ul/kg
ihl rat LC50	8000 ppm/4h
ipr rat LD50	1130 mg/kg
scu rat LD50	2170 mg/kg
orl mus LD50	1400 mg/kg
ipr mus LD50	1230 mg/kg
skn rbt LD50	1 ml/kg
ipr rbt LD50	1540 mg/kg
orl mam LD50	3 gm/kg
ihl mam LC50	25 gm/m3
Cyclohexanone	(Gupta et al. 1979)
ipl mus LD50	1.23 g/kg
orl mus LD50 m	2.07 g/kg
orl mus LD50 f	2.11 g/kg
ipl rat LD50	1.13 g/kg
orl rat LD50 m	1.8 g/kg
orl rat LD50 f	1.8 g/kg
ipl rbt LDd50	1.54 g/kg
ipl gpg LD50	0.93 g/kg
Diethyl malonate	(Aldrich Chemical Company 1995)
LD50 rat orl	1500 mg/kg
LD50 mus orl	6400 mg/kg

Chemical	Value and Source
LD50 rbt skn	500 mg/24hr
LD50 gpg skn	10 ml/kg
Diethyl malonate	(Bennett et al. 1984)
LD50 orl rat	1500 mg/kg
LD50 orl mus	6400 mg/kg
Diethyl phthalate	(IRIS1995)
NOAEL	1% of diet (750 mg/kg bw/day)
LOAEL	5% of diet (3160 mg/kg bw/day)
RfD	8E-1 mg/kg/day
Diethyl phthalate	(J T Baker Inc. 1989a)
orl rat LD50	6800 mg/kg
OSHA PEL	5 mg/m3
ACGIH TLV	5 mg/m3
Diethyl phthalate	(Lewis 1992)
orl rat LD50	8600 mg/kg
ipr rat LD50	5058 mg/kg
orl mus LD50	6172 mg/kg
ipr mus LD50	2749 mg/kg
orl gpg LD50	8600 mg/kg
Diethyl phthalate	Toxicological Profile for Diethyl Phthalate
LD50 rat	8 g/kg
Diethyl phthalate	(HMIS 1994)
LD50 orl rat	8600 mg/kg
LC50 ihl rat	7510 mg/m3
LD50 ipl rat	5058 mg/kg
LD50 orl mus	6172 mg/kg
Diethyl phthalate	
LD50 orl rat	9000 mg/kg
Diethyl phthalate	(Woodward 1986)
LD50 rat	7 g/kg
Diethyl phthalate	(Bennett et al. 1984)
LD50 orl rat	9000 mg/kg
LD50 orl mus	6172 mg/kg
LDlo orl rbt	1000 mg/kg
TClo ihl hum	1000 mg/m3
LC50 ihl rat	7510 mg/m3
LC50 ihl mus	4890 mg/m3
LC50 ihl mam	8240 mg/m3
Dimethyl phthalate	(Woodward 1986)
LD50 rat	7 g/kg
LD50 bird	100 mg/kg
Dimethyl phthalate	(Woodward 1986)
LD50 rat	8 g/kg
Dimethyl phthalate	(HMIS 1994)
LD50 orl rat	6800 mg/kg
LD50 skn rat	>4800 mg/kg
LD50 ipr rat	3375 ul/kg
LD50 unr rat	9500 mg/kg
LD50 orl mus	6800 mg/kg
LD50 ipr mus	1380 mg/kg
LD50 unr mus	6800 mg/kg

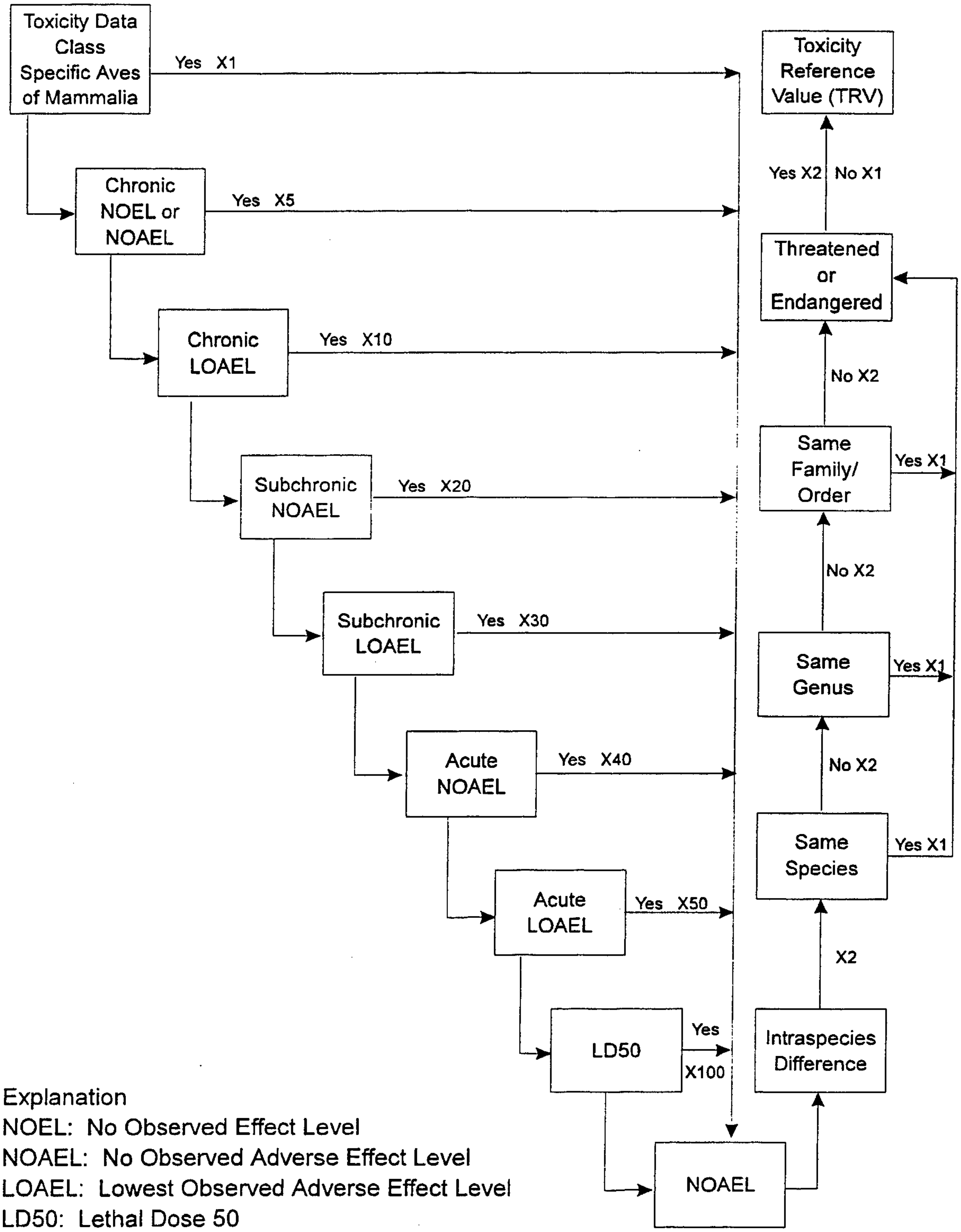
Chemical	Value and Source
LD50 orl rbt	4400 mg/kg
LD50 skn rbt	>20 ml/kg
LD50 orl gpg	2400 mg/kg
LD50 skn gpg	>10 gm/kg
LD50 unr gpg	4800 mg/kg
LD50 upl ckn	8500 mg/kg
Dimethyl phthalate	(HMIS 1994)
LD50 orl rat	9000 mg/kg
Dimethyl phthalate	(Lewis 1992)
orl rat LD50	6800 mg/kg
ipr rat LD50	3375 mg/kg
orl mus LD50	6800 mg/kg
ipr mus LD50	1380 mg/kg
orl rbt LD50	4400 mg/kg
orl gpg LD50	2400 mg/kg
orl ckn LD50	8500 mg/kg
OSHA PEL	TWA 5mg/m3
ACGIH TLV	TWA 5mg/m3
Ethyl phthalate	(Lewis 1992)
LD50 orl rat	8600 mg/kg
LD50 ipr rat	5058 mg/kg
LD50 orl mus	6172 mg/kg
LD50 ipr mus	2749 mg/kg
LD50 orl gpg	8600 mg/kg
Ethyl phthalate	(HMIS 1994)
OSHA TWA	5 mg/m3
ACGIH TWA	5 mg/m3
NIOSH TWA (10 hour)	5 mg/m3
TClo ihl hum	1000 mg/m3
LD50 skn gpg	>20 ml/kg
LD50 orl rat	8600 mg/kg
LD50 orl mus	6172 mg/kg
LD50 orl rbt	1gm/kg
LD50 orl gpg	8600 mg/kg
TDlo 14 day orl rat	44240 mg/kg
TDlo 6 weeks orl rat	133 gm/kg
TDlo 16 weeks orl rat	354 gm/kg
LD50 subcut gpg	3 gm/kg
LDlo iv rbt	100 mg/kg
Eucalyptol	(Lewis 1992)
LD50 orl rat	2480 mg/kg
LD50 ims mus	100 mg/kg
LDlo scu dog	1500 mg/kg
LDlo ims gpg	2250 mg/kg
Methyl salicylate	(Bennett et al. 1984)
LDlo orl hum	506 mg/kg
LD50 orl rat	887 mg/kg
LD50 orl dog	2100 mg/kg
LD50 orl rbt	1300 mg/kg
LD50 orl gpg	1060 mg/kg

Chemical	Value and Source
Methyl salicylate	(J.T. Baker Inc. 1989b)
LD50 orl rat	887 mg/kg
LD50 orl rbt	1300 mg/kg
Methyl salicylate	(Lewis 1992)
oral rat LD50	887 mg/kg
oral mus LD50	1110 mg/kg
oral dog LD50	2250 mg/kg
orl rbt LD50	1300 mg/kg
orl gpg LD50	1060 mg/kg
Methyl salicylate	(Opdyke 1979)
oral mus LD50	1110 mg/kg
oral mus LD50	887 mg/kg
oral rat LD50	1250 mg/kg
oral gpg LD50	1060 mg/kg
oral gpg LD50	700 mg/kg
oral rbt LD50	1300 mg/kg
oral rbt LD50	2800 mg/kg
oral dog LD50	2100 mg/kg
Methyl salicylate	(Sadusky 1990)
LDlo orl hum	506 mg/kg
LD50 orl rat	887 mg/kg
LD50 orl dog	2100 mg/kg
LD50 orl rbt	1300 mg/kg
LD50 orl gpg	1060 mg/kg
Methyl salicylate	(HMIS 1994)
LD50 orl rat	887 mg/kg
Sodium carbonate	(Lewis 1992)
LD50 orl rat	4090 mg/kg
LC50 ihl rat	2300 mg/m3/2H
LC50 ihl mus	1200 mg/m3/2H
LD50 ipr mus	117 mg/kg
LD50 scu mus	2210 mg/kg
LC50 ihl gpg	800 mg/m3/2H
Polyethylene oxide	(Lewis 1992)
LD50 orl rat	50 g/kg
LD50 ipr rat	11550 mg/kg
LD50 scu mus	18 g/kg
LD50 ivn mus	16 g/kg
LD50 orl rbt	76 g/kg
LD50 orl gpg	50900 mg/kg
Hydroxyethyl cellulose	(Lewis 1992)
LD50 orl rat	4270 mg/kg
LD50 orl mus	6500 mg/kg
LC50 ihl mus	4 g/m3/2H
LD50 skn rbt	3560 mg/kg
LD50 unr mam	26 g/kg
Glycerol	(Lewis 1992)
LD50 orl rat	12600 mg/kg
LD50 ipr rat	8728 mg/kg

Chemical	Value and Source
LD50 scu rat	100 mg/kg
LD50 ivn rat	5566 mg/kg
LD50 orl mus	4090 mg/kg
LD50 ipr mus	8982 mg/kg
LD50 scu mus	91 mg/kg
LD50 inv mus	6199 mg/kg
LD50 ivn rbt	53 mg/kg
LD50 orl gpg	7750 mg/kg
Glycerol	(HMIS 1994)
OSHA PEL	10 mg/m3
ACGIH TLV	10 mg/m3
Diethyl malonate (DEM)	(HMIS 1994)
LD50 rat oral	1500 mg/kg
LD50 mouse oral	6400 mg/kg
Ferrous ammonium sulfate	(HSDB 1987)
NIOSH TWA	1 mg/m^3
2,2 Dipyridyl	(R.W. Grady et al 1976)
LD50 ipl mus	200 mg/kg
2,2 Dipyridyl	(Lewis 1992)
LD50 orl rat	100 mg/kg
LD50 scu rat	131 mg/kg
LD50 ipr mus	200 mg/kg
Phenophthalein	(Lewis 1992)
LDdlo ipr rat	500 mg/kg
Isopropyl alcohol (isopropanol)	(J.T. Baker Inc. 1990)
LD50 skn rbt	13 g/kg
OSHA PEL	900 mg/kg
Isopropal alcohol (isopropanol)	(NIOSH 1976)
LD50 orl 14 day old rat	5.6 ml/kg
LD50 orl young adult rat	6.0 ml/kg
LD50 orl older adult rat	6.8 ml/kg
LD50 orl rbt	10.2 ml/kg
LD50 skn rbt	16.4 ml/kg
Isopropal alcohol (isopropanol)	(Lewis 1992)
LD50 orl rat	5045 mg/kg
LD50 ipr rat	2735 mg/kg
LD50 ivn rat	1099 mg/kg
LD50 orl mus	3600 mg/kg
LD50 ipr mud	4477 mg/kg
LD50 ivn mus	1509 mg/kg
LD50 orl dog	4797 mg/kg
LD50 skn rbt	12800 mg/kg
LD50 ipr rbt	667 mg/kg
LD50 ipr gpg	2560 mg/kg
LD50 ipr ham	344 mg/kg
Titanium dioxide	(Lewis 1992)
TCLo, ihl rat	250 mg/m^3

Chemical	Value and Source
PEG 200 (mixed butyl mercaptan)	
oral daily 13 wks (monkeys)	lesions, oxalate crystals in the renal cortex
no adverse effects	oral daily for 13 wks (rats)
LDo,Edo mice ipl 1 dose	no observed effects
LD50 rat, iv, acute	>10.0 mg/kg
LD50 rat orl	28.13 gm/kg
LD50 ipl mouse	7.5 ml/kg
LD100 ipl mouse	10.0 mg/kg
EDo ipl mouse	1.0 mg/kg
PEG 200 (mixed butyl mercaptan)	(Orca 1988)
LD50 orl rat	28,900 mg/kg
LD50 orl mus	38,300 mg/kg
LD50 orl rbt	19,900 mg/kg
PEG 200 (mixed butyl mercaptan)	(Bennett et al. 1984)
LD50 orl rat	28,900 mg/kg
LD50 orl mus	38,300 mg/kg
LD50 orl rbt	19,900 mg/kg
PEG 200 (mixed butyl mercaptan)	(Lewis 1992)
LD50 orl rat	28900 mg/kg
LD50 orl mus	38300 mg/kg
LD50 ipr mus	7500 mg/kg
LD50 orl rbt	19900 mg/kg

ACGIH- American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH - National Institute for Occupational Safety and Health
TWA - time weighted average
STEL - standard threshold exposure limit
PEL - permissible exposure limit
MSDS - material safety data sheet
NOEL -no observable effect level
TClo - lowest concentration to produce a toxic effect
TDlo - lowest dose to produce a toxic effect
LDlo - lowest lethal dose
EDo - dose at which effects were observed
ihl- inhalation
ipl - intraperitoneal
inv - intravenous
orl - oral
scu - subcutaneous
skn - skin (dermal)
ocu - ocular
ims - intramuscular
unr - route unreported
mus - mouse
rbt - rabbit
gpg - guinea pig
ham - hamster
mam - mammal
ckn - chicken



Explanation
NOEL: No Observed Effect Level
NOAEL: No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
LD50: Lethal Dose 50

Figure 10. Decision tree for calculating TRV derivation (Wentsel et al. 1994).

TABLE 11. Calculations of Toxicity Reference Values for selected chemicals.

Chemical	Pathway	Biological Target		Toxicity Value	Uncertainty Factor for TRV	TRV
Fog oil chronic	Inhalation	Bats	0.1	g/m^3 $LOAEL_{dog, rat, mus, rbt,}$	160	.00063 g/m^3
		Eagles	0.1	g/m^3 $LOAEL_{adog, rat, mus, rbt}$	320	.00031 g/m^3
Fog oil acute	Inhalation	Bats	60	g/m^3 LC_{50} rat	16	3.8 g/m^3
		Eagles	60	g/m^3 LC_{50} rat	32	1.88 g/m^3
Fog oil chronic	Ingestion	Bats	22	g/kg LD_{50} mus	1600	0.014 g/kg
		Eagles	22	g/kg LD_{50} mus	3200	0.0069 g/kg
Fog oil acute	Ingestion	Bats	17.6	g/kg LOAEL rat	16	1.1 g/kg
		Eagles	17.6	g/kg LOAEL rat	32	0.55 g/kg
Fog oil chronic	Dermal	Bats	2	g/kg LOAEL rat	160	1.4 g/kg
		Eagles	2	g/kg LOAEL rat	320	0.68 g/kg
Fog oil acute	Dermal	Bats	216	g/kg TD_{lo}mus	16	0.13 g/kg
		Eagles	216	g/kg TD_{lo}mus	32	0.0625 g/kg
TPA	Inhalation	Bats	8.62	g/m^3 calculated NOAEL	1	8.6200 g/m^3
		Eagles	8.62	g/m^3 calculated NOAEL	32	0.2694 g/m^3
Kaolin	Inhalation	Bats	0.01	g/m^3 ACGIH TLV	16	0.0006 g/m^3
		Eagles	0.01	g/m^3 ACGIH TLV	32	0.0003 g/m^3
Dimethyl phthalate	Ingestion	Bats	6.8	g/kg NOAEL rat	1600	0.0043 g/kg
		Eagles	6.8	g/kg NOAEL rat	3200	0.0021 g/kg
Sodium Carbonate	Inhalation	Bats	2.3	g/m^3 LC_{50} rat	1600	0.0014 g/m^3
		Eagles	2.3	g/m^3 LC_{50} rat	3200	0.0007 g/m^3
	Ingestion	Bats	4.09	g/kg LD_{50} rat	1600	0.0026 g/kg
		Eagles	4.09	g/kg LD_{50} rat	3200	0.0013 g/kg
Polyethylene oxide	Inhalation	Bats	50000	g/m^3 from LD_{50} rat	1600	31.2500 g/m^3
		Eagles	50000	g/m^3 from LD_{50} rat	3200	15.6250 g/m^3
	Ingestion	Bats	50	g/kg LD_{50} rat	1600	0.0313 g/kg
		Eagles	50	g/kg LD_{50} rat	3200	0.0156 g/kg
Hydroxyethylcellulose	Inhalation	Bats	4	g/m^3 LC_{50} rat	1600	0.0025 g/m^3
		Eagles	4	g/m^3 LC_{50} rat	3200	0.0013 g/m^3
	Ingestion	Bats	4.27	g/kg LD_{50} mouse	1600	0.0027 g/kg
		Eagles	4.27	g/kg LD_{50} mouse	3200	0.0013 g/kg
Glycerol	Inhalation	Bats	0.01	g/m^3 OSHA PEL human	1600	0.0006 g/m^3
		Eagles	0.01	g/m^3 OSHA PEL human	3200	0.0003 g/m^3
	Ingestion	Bats	12.6	g/kg LD_{50} rat	1600	0.0079 g/kg
		Eagles	12.6	g/kg LD_{50} rat	3200	0.0039 g/kg
Diethyl malonate	Inhalation	Bats	1500	g/m^3 from LD_{50} rat	1600	0.9375 g/m^3
		Eagles	1500	g/m^3 from LD_{50} rat	3200	0.4688 g/m^3

Chemical	Pathway	Biological Target		Toxicity Value	Uncertainty Factor for TRV	TRV
	Ingestion	Bats	1.5	g/kg LD_{50} rat	1600	0.0009 g/kg
		Eagles	1.5	g/kg LD_{50} rat	3200	0.0005 g/kg
Ferrous ammonium sulfate	Inhalation	Bats	0.001	g/m^3 NIOSH	1600	6 E-7 g/m^3
		Eagles	0.001	g/m^3 NIOSH	3200	3 E-7 g/m^3
Methyl salicylate	Inhalation	Bats	1.5	g/m^3 LD_{50} human	1600	0.0009 g/m^3
		Eagles	1.5	g/m^3 LD_{50} human	3200	0.0005 g/m^3
	Ingestion	Bats	0.887	g/kg LD_{50} rat	1600	0.0006 g/kg
		Eagles	0.887	g/kg LD_{50} rat	3200	0.0003 g/kg
2,2-Dipyridyl	Inhalation	Bats	100	g/m^3 LD_{50} rat	1600	0.0625 g/m^3
		Eagles	100	g/m^3 LD_{50} rat	3200	0.0313 g/m^3
	Ingestion	Bats	0.1	g/kg LD_{50} rat	1600	0.0001 g/kg
		Eagles	0.1	g/kg LD_{50} rat	3200	0.00005 g/kg
Phenophthalein	Inhalation	Bats	500	g/m^3 LD_{lo} rat	1600	0.3125 g/m^3
		Eagles	500	g/m^3 LD_{lo} rat	3200	0.1563 g/m^3
	Ingestion	Bats	0.5	g/kg LD_{lo} rat	1600	0.0003 g/kg
		Eagles	0.5	g/kg LD_{lo} rat	3200	0.0002 g/kg
Isopropanol	Inhalation	Bats	0.9	g/m^3 OSHA PEL human	1600	0.0006 g/m^3
		Eagles	0.9	g/m^3 OSHA PEL human	3200	0.0003 g/m^3
	Ingestion	Bats	5.05	g/kg LD_{50} rat	1600	0.0032 g/kg
		Eagles	5.05	g/kg LD_{50} rat	3200	0.0016 g/kg
Titanium dioxide	Inhalation	Bats	0.25	g/m^3 TC_{lo} rat	1600	0.0002 g/m^3
		Eagles	0.25	g/m^3 TC_{lo} rat	3200	0.0001 g/m^3
PEG 200	Inhalation	Bats	28900	g/m^3 from LD_{50} rat	1600	18.0625 g/m^3
		Eagles	28900	g/m^3 from LD_{50} rat	3200	9.0313 g/m^3
	Ingestion	Bats	28.9	g/kg LD_{50} rat	1600	0.0181 g/kg
		Eagles	28.9	g/kg LD_{50} rat	3200	0.0090 g/kg
Ethyl phthalate	Ingestion	Bats	8.6	g/kg LD_{50} rat	1600	0.0054 g/kg
		Eagles	8.6	g/kg LD_{50} rat	3200	0.0027 g/kg
	Inhalation	Bats	1	g/m^3 TC_{lo} human	1600	0.0006 g/m^3
		Eagles	1	g/m^3 TC_{lo} human	3200	0.0003 g/m^3

ACGIH- American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH - National Institute for Occupational Safety and Health
PEL - permissible exposure limit

Section 8
Exposure Assessment

Section VIII:

Exposure Assessment

8.1 INTRODUCTION

Exposure assessment is the process of converting predicted stressor concentrations at the contact point into a dose. For our predictive ERA, we used an air dispersion model to determine the concentration of fog oil smoke, terephthalic acid smoke, and titanium dioxide smoke at contact points. To assess the dispersion of stressors we did not model, we evaluated the mode and length of release to predict stressor concentration in the environment.

We performed a screening level risk assessment to determine which stressors had potential to adversely affect receptors. We were able to eliminate many chemical stressors from detailed analysis as described in Section 8.2. We used the following criteria to select chemicals of potential concern from the screening risk assessment:

- existence of a complete exposure pathway
- Hazard Quotient calculated in screening risk assessment greater than 1.0
- known carcinogenic properties

We competed three basic steps in assessing exposure: identify exposure pathways, characterize exposure setting, and quantify exposure. In ecological risk assessments, exposure assessments and toxicity assessments often are combined into an analysis phase (EPA 1992b). We performed a toxicity assessment first and incorporated the information into the exposure assessment.

8.2 IDENTIFICATION OF COMPLETE EXPOSURE PATHWAYS

A complete exposure pathway consists of a receptor, chemical source or release (stressor), exposure point, and exposure route. We evaluated the potential for each stressor to contact receptors through inhalation, ingestion, or dermal absorption pathways. The screening risk assessment was performed to determine which stressors had potential to adversely affect receptors. We estimated the concentration of each stressor based on the quantity expected to be used at Fort Leonard Wood. We examined the method of release, release location, and release mechanism. Stressors with exposure pathways that would not, based on information provided, reach receptors were eliminated from further analysis. All proposed BIDS Training, FOX Training, and non-specific simulants were eliminated in this manner except titanium dioxide.

8.2.1 Stressors Eliminated Due to Incomplete Exposure Pathways

We eliminated certain stressors in the screening risk assessment based on proposed location of use or deployment mechanism at Fort Leonard Wood (Table 12). We do not believe there is potential for these chemicals to contact receptors.

8.2.2 Stressors Eliminated Based on Toxicity or Quantity

Three Persistent Chemical Training Simulants (PCAS); Soman (GD), Mustard Lewisite, and Chemical Agent Disclosure Solution (CADS), were evaluated in the screening risk assessment. Toxicity values for GD, Mustard Lewisite, and CADS could not be identified; we used toxicity values for individual chemical constituents of each PCAS.

PCAS will be dispersed remotely, using the Chemical/Biological Training Simulant and Delivery System (CBTSADS), or will be dispersed manually. We evaluated PCAS dispersed from a CBTSADS. It is estimated the CBTSADS will disperse PCAS over an area of 10,000 m^2. We evaluated PCAS based on yearly use of 1800 liters (9 liters per training event, 200 training events per year) and training duration of 2 hour per event. We assumed PCAS would be dispersed in 100,000 m^3 of air. Concentrations of PCAS components dispersed by CBTSADS will be below toxicity threshold values for Indiana bats, gray bats, or bald eagles. PCAS were therefore eliminated from further assessment in the ERA.

TABLE 12. Chemical stressors eliminated from detailed analysis in the Ecological Risk Assessment based on expected location of use and/or deployment mechanism at Fort Leonard Wood.

Chemical Stressor	Reason for Elimination
FOX training simulants	
Anisole	FOX simulant only for interior training in the FOX Simulator therefore, chemical will not contact receptors
Benzaldehyde	see anisole
Cyclohexane	see anisole
DEM - diethyl malonate	see anisole
Diethyl phthalate	see anisole
Dimethyl phthalate	FOX simulant for interior and exterior training. In exterior FOX simulant training, a small hole is dug and a pan is placed in the hole. Approximately 40 pounds of clean sand are placed in the pan, into which the simulant is poured. After the exercise is complete, the pan is removed and reused in another exercise. There is not sufficient time for the simulant to contact receptors or their food sources as long as the pan of sand is removed within 2 hours of placement.
Ethyl phthalate	same as dimethyl phthalate
Eucalyptol	same as dimethyl phthalate
MES - Methyl salicylate	same as dimethyl phthalate
Non-specific simulants	
PEG 200	PEG 200 will be used at a maximum of 8 hasty decontamination sites. The field training exercise will involve ground based liter containers. These containers will spray PEG 200 into the air (approximately 5 m) when triggered. The purpose of the exercise is to cover equipment and personnel with PEG 200, so soldiers can practice decontamination procedures. There is not a complete exposure pathway for bats or bald eagles as long as PEG 200 is not sprayed into trees, and is used outside bat management zones.

PCAS are also dispersed manually. A hand pump will be used to spray 1 pint bottles with spray heads. PCAS is delivered directly on the ground. This dispersion method does not present a direct exposure pathway for Indiana bats, gray bats, or bald eagles.

8.2.3 Stressors Carried Through Detailed Ecological Risk Assessment

Upon completion of screening processes, fog oil, terephthalic acid, and titanium dioxide warranted detailed analysis. These stressors were evaluated to assess effects to Indiana bats, gray bats, and bald eagles on Fort Leonard Wood.

8.3 CHARACTERIZATION OF EXPOSURE SETTING

We examined life history data for each receptor, including portion of their life spent on the installation and diet composition. Food sources can act as exposure sites. A description of soil types, geology, hydrology, flora, and fauna on the Installation is provided in Section V. This information facilitates interpretation of the environmental fate of stressors.

8.3.1 Indiana Bats

Indiana bats at Fort Leonard Wood may be exposed to stressors while foraging, roosting, or hibernating on the Installation (Figure 11). Stressors may be ingested, inhaled, or dermally absorbed by Indiana bats. Indiana bats may be exposed to stressors directly, or may be exposed through another source (e.g. contaminated insect prey).

8.3.1.1 Foraging Indiana Bats

Indiana bats forage at Fort Leonard Wood from April through October. Section 3.1.4 of this appendix provides additional information regarding foraging habits of Indiana bats. Figure 12 presents a primary food chain for Indiana bats at Fort Leonard Wood. This food chain illustrates food sources of the Indiana bat and the food sources of typical prey.

8.3.1.2 Roosting Indiana Bats

Male, female, and young Indiana bats roost, primarily during daylight hours, in trees during the summer. Potentially suitable habitat occurs nearly installation-wide. Information regarding roosting activities of Indiana bats is provided in Section 3.1.3 of this appendix.

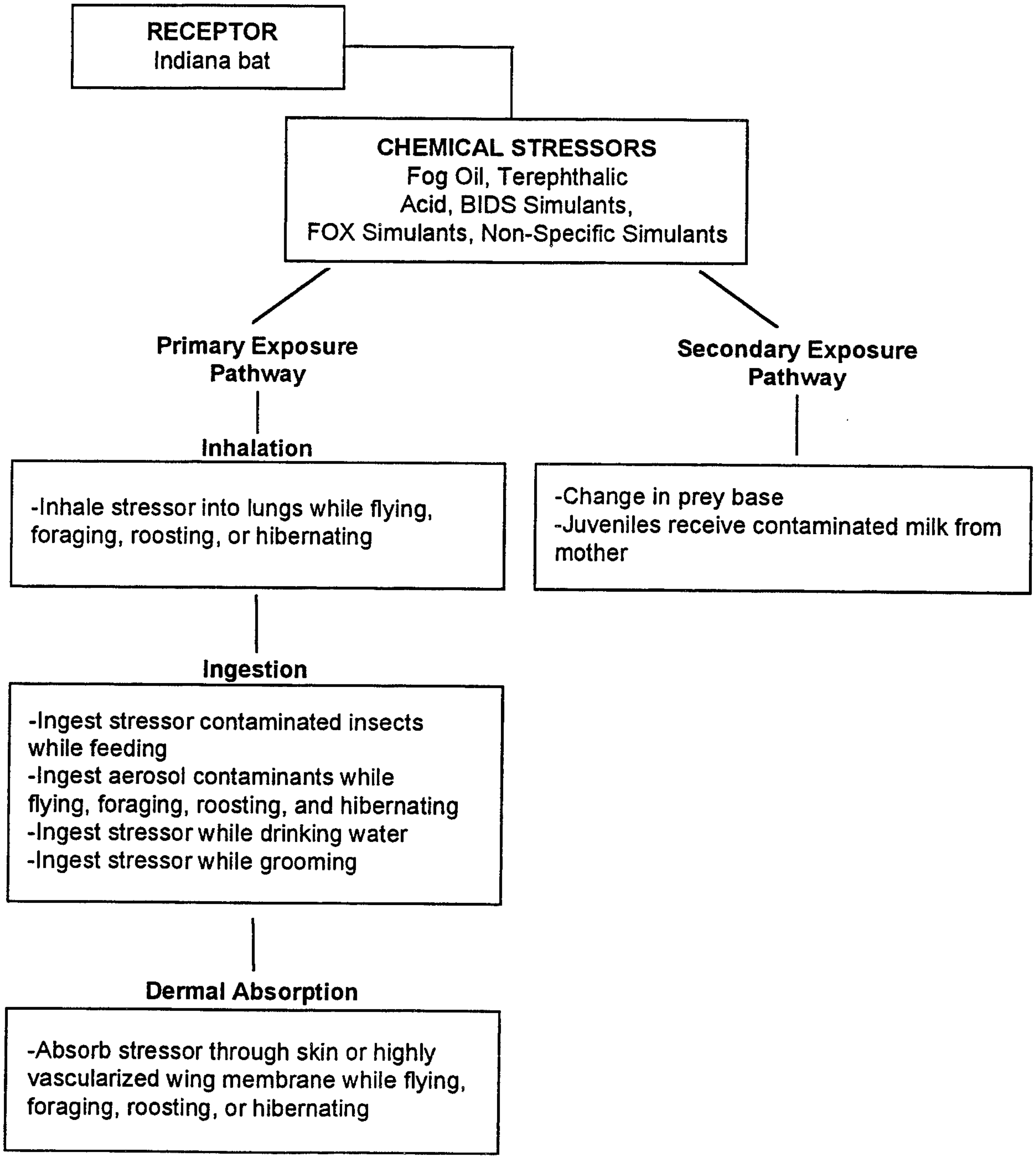


FIGURE 11. Pathways through which Indiana bats may be exposed to stressors at Fort Leonard Wood.

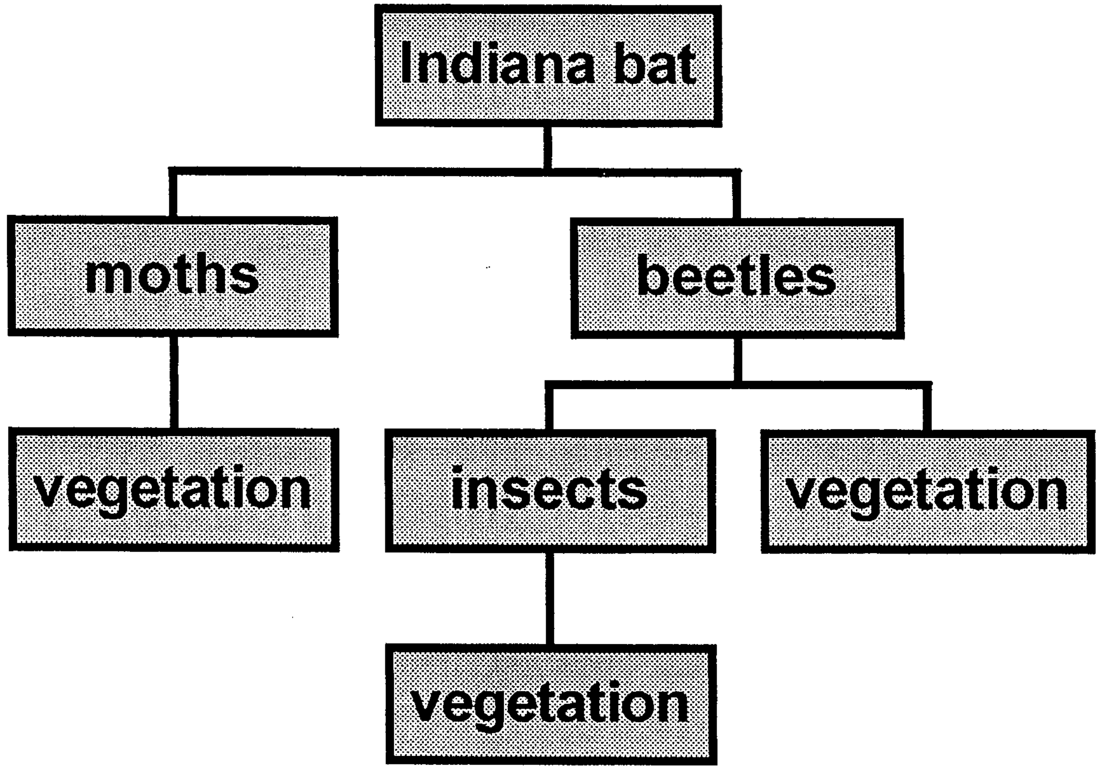


FIGURE 12. Food chain of Indiana bats at Fort Leonard Wood, Missouri.

8.3.1.3 Hibernating Indiana Bats

Indiana bats hibernate in 4 caves at Fort Leonard Wood: Brooks, Wolf Den, Davis No. 2, and Joy (Figure 13). Indiana bats also hibernate in Great Spirit Cave, near the installation (Figure 13). Additional information regarding Indiana bat hibernation is provided in Section 3.1.3 of this Appendix.

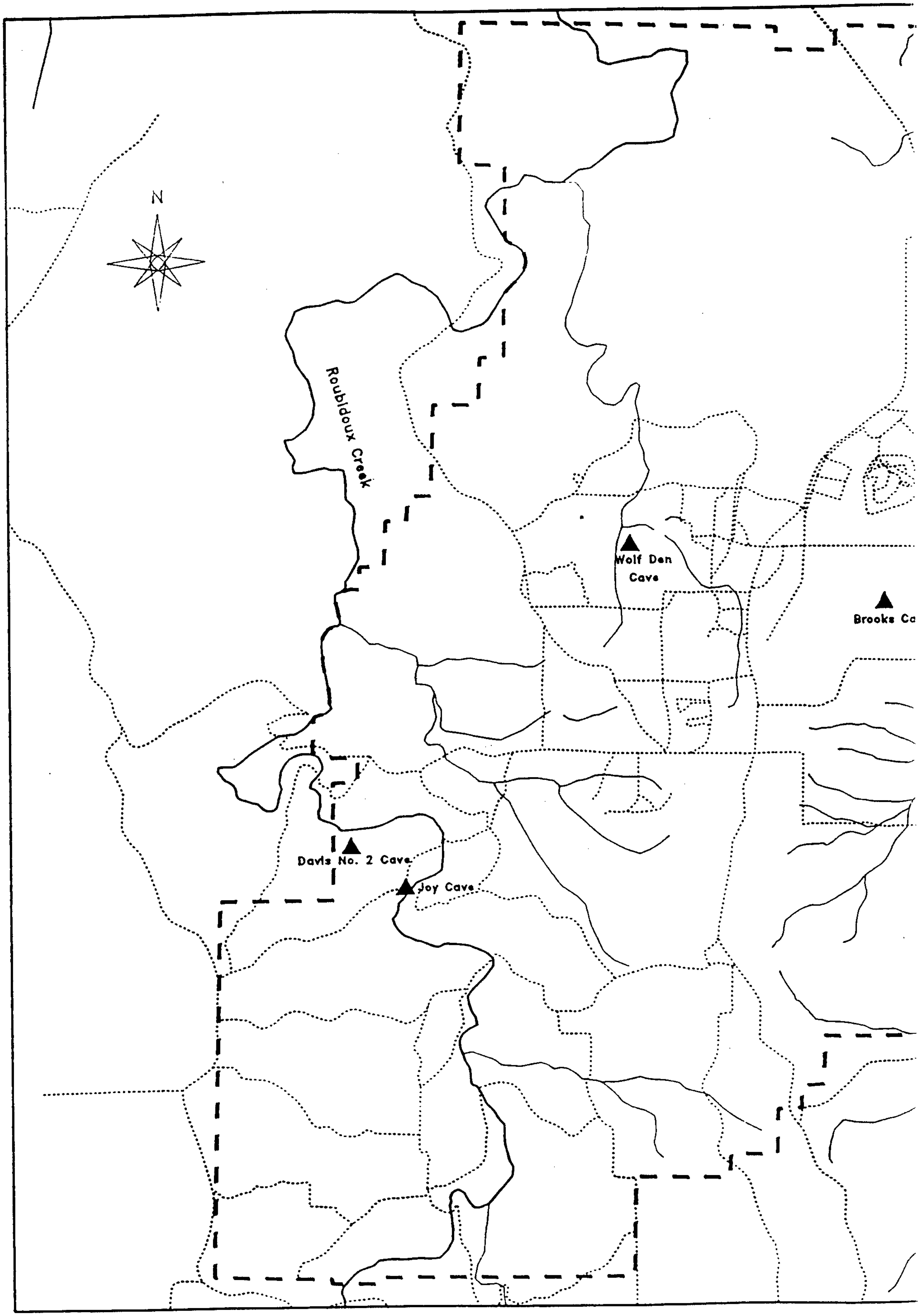
Indiana Bat Hibernacula

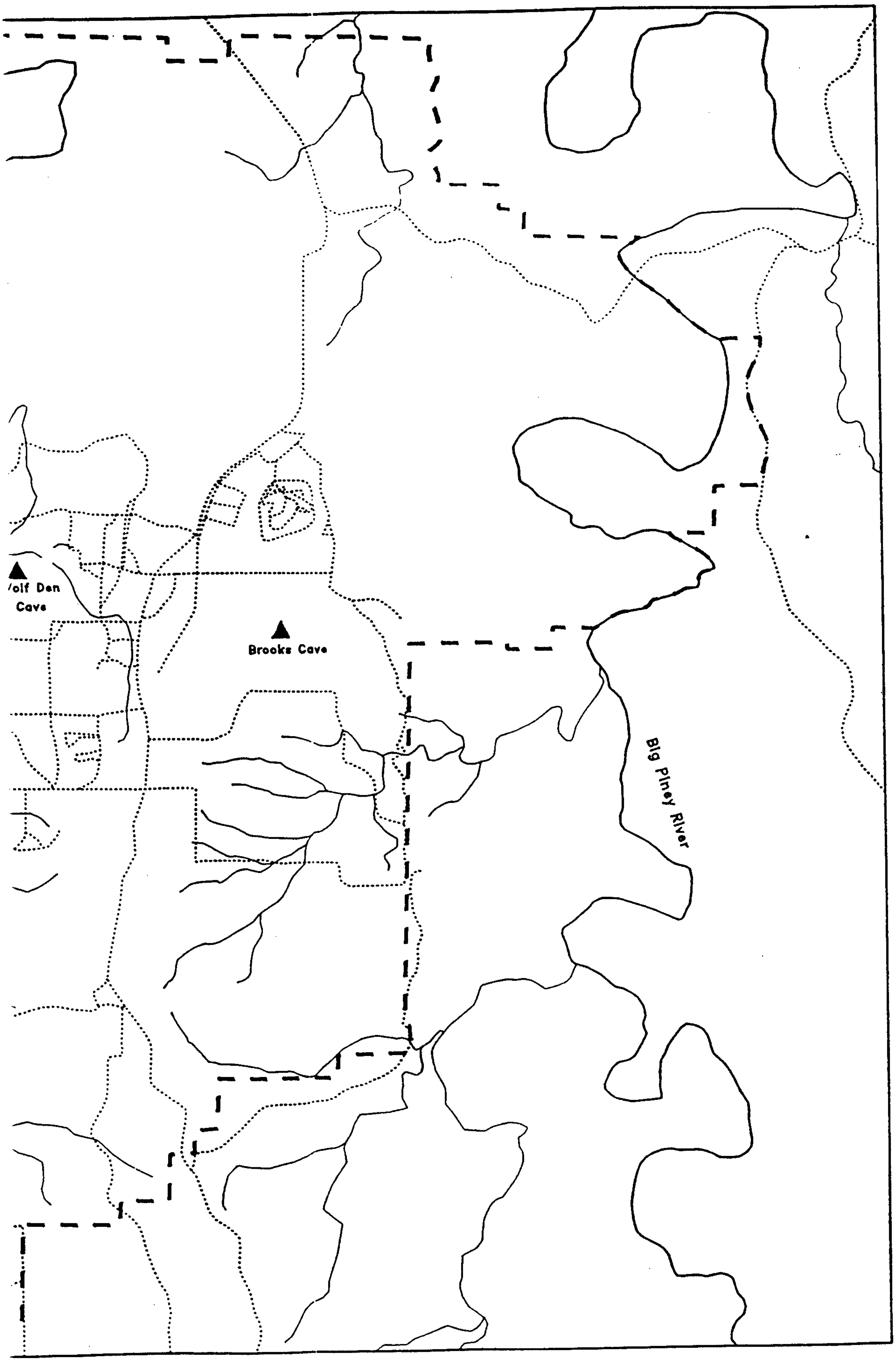
Indiana bats may be exposed to chemical stressors in hibernacula. Physical characteristics of hibernacula can influence chemical behavior inside the cave. Stressors can persist, or be rapidly removed from the cave atmosphere depending on the size and air flow dynamics of the cave. Table 13 provides describes each hibernaculum on the installation.

The entrance to Brooks Cave is in a sinkhole. The top of the sinkhole is approximately 30 m by 50 m. Within the sinkhole is a smaller sink, approximately 9 m in diameter. The entrance to the cave is located within the inner sink. The entrance faces west and is 1.5 m high and 2.5 m wide. The cave floor drops from the entrance at a 24° angle for 38 m, opening into a main room which has a flat ceiling and floor. The main room is approximately 5 m high, 10 m wide, and 57 m long. Most Indiana bats hibernate on the ceiling of the main room. The

TABLE 13. Characteristics of Indiana bat hibernacula on Fort Leonard Wood.

	Brooks	Wolf Den	Joy	Davis No. 2
Entrance area (ft^2)	38	72	262	147 and 10
Cave volume (ft^3)	180,860	110,906	81,965	94,460
Entrance area/cave volume ft^2/cm	6.89E-06	2.13E-05	1.05E-04	3.47E-06


N
Roubidoux Creek
Wolf Den Cave
Brooks Ca
Davis No. 2 Cave
Joy Cave



APPENI

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FIGURE 13. In
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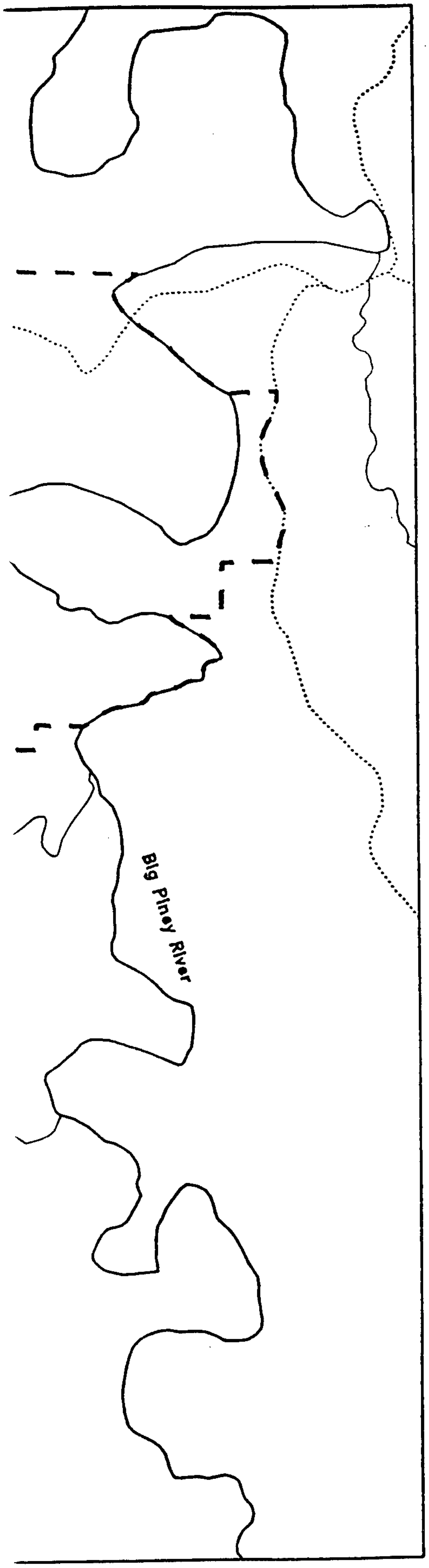


APPENDIX IV TO
BIOLOGICAL ASSESSMENT:
RELOCATION OF U.S. ARMY CHEMICAL
SCHOOL AND MILITARY POLICE SCHOOL
TO FORT LEONARD WOOD, MISSOURI

FIGURE 13. Indiana bat hibernacula on Fort Leonard Wood, Missouri.

▲ Indiana Bat Cave

Fort Leonard Wood Boundary

Road

River / Stream

Kilometers

0 2 4

3D/ENVIRONMENTAL

cave terminates at a sandstone breakdown in a room 10 m high and 15 m wide. The cave has a total length of 135 m. The passage beyond the main room is not suitable for hibernation of Indiana bats, but it affects airflow dynamics in the cave.

The entrance to Wolf Den Cave is on the western side of a sinkhole that is approximately 8 m deep. The entrance to the cave is restricted by breakdown. There are 3 openings (the largest of which is 1 m high and 2 m wide) to the same passage. The cave floor and ceiling slope down 40° from the entrance for 20 m. The floor and ceiling become flat, forming a large room which is 25 m long. Most Indiana bats hibernate on the ceiling of this area of the cave. The floor inclines steadily for the next 16 m until it meets the ceiling where the passage ends.

Joy Cave is located on an east-facing bluff in the Roubidoux Creek valley. The entrance faces southeast. At the dripline, the entrance is 4 m high and 16 m wide. Excavations near the entrance, combined with collapses of the sandstone ceiling, create a floor that varies in elevation. The ceiling is mostly flat and level throughout the cave. About 35 m into the cave, the passage turns to the north. A rise in the ceiling forms a domed room where most of the Indiana bats hibernate. At the back of this dome room, the ceiling drops until the total passage height is 0.8 m. The passage (approximately 1 m high and 10 m wide) continues another 30 m before turning east. The passage turns north again after 30 m. A dry passage splits off to the northeast and ends within 10 m. A passage (1.5 m high and 2 m wide) containing a stream continues to the northwest.

Davis No. 2 Cave passes through a ridge (i.e., there is an entrance on each side) on the south side of Roubidoux Creek. The larger entrance (2.1 m high and 7 m wide) faces northeast, toward the creek. The passage turns 35 m from the main entrance, and continues for another 12 m where the ceiling rises slightly to form a dome. Most Indiana bats hibernate in this area of the cave. The passage continues another 114 m before the small cave entrance (0.8 m high and 1.4 m wide) is reached. The two entrances in this cave permit, under certain conditions, airflow through the cave.

Air Flow at Indiana Bat Hibernacula

3D/Environmental installed meteorological stations at the entrance, and inside each Indiana bat hibernacula. We collected data from October through March to characterize air flow into and out of each cave. We developed models describing seasonal air flow in each cave. Table 14 presents information used to develop air flow models for each cave. No air flow model was developed for Great Spirit Cave. We assessed effects to Indiana bats within the cave based on the concentration of contaminants expected to reach the cave. Contaminant concentrations were assumed consistent throughout the training event.

Air flow models were used to determine the time a contaminant would remain in the air inside each cave. The models are based on the amount of time required for the contaminant to reach equilibrium inside the cave. Caves that maintain a positive barometric pressure gradient inside (pressure greater inside than outside), will reach equilibrium faster and the contaminant will not remain in the air as long as a cave with a negative pressure gradient. The following equations describe the cave air flow model.

Equation 1 - Determining contaminant concentrations inside the cave

$$C_1kt = X$$

where:

C_1 = Concentration g/m^3 at the mouth
k = mixing constant 1/seconds
t = time in seconds concentration is at the mouth (e.g. amount of time generators are running)
X = Concentration g/m^3 inside the cave

Equation 2 - Calculating the equilibrium constant for a concentration

$$\frac{-lnX}{Cc} = Ec$$

where:

$(-ln)$ = natural logarithm
X = Concentration g/m^3 inside the cave
Cc = Concentration of concern (i.e. TRV or NOAEL)
Ec = Equilibrium constant for concentration

TABLE 14. Information used to develop air flow models for Indiana bat hibernacula at Fort Leonard Wood, Missouri.

Parameter	Brooks Cave	Wolf Den Cave	Joy Cave	Davis No. 2 Cave
Cave maximum temperature (K)	286	294	287	291
Cave minimum temperature (K)	278	276	267	267
Cave maximum pressure (mbar)	1007	1004	1002	1026
Cave minimum pressure (mbar)	959	958	959	960
Maximum computed air velocity (1 mbar dP, cm/s)	41.3399	41.9360	41.4121	41.6780
Minimum computed air velocity (1 mbar dP, cm/s)	39.7744	39.6902	39.0767	38.6169
Maximum flow rate/cave volume (1/s)	0.0003	0.0009	0.0043	0.0001
Minimum flow rate/cave volume (1/s)	0.00027	0.0008	0.0041	0.0001
Measured dispersion constant range (Q/KV)	0.0099-0.0021	0.0121-0.0036	0.0054-0.0021	0.0101-0.0035
Highest correlation dispersion constant	0.0099	0.0057	0.0054	0.0035
Maximum mixing constant (1/s)	0.0288	0.1567	0.8042	0.0413
Minimum mixing constant (1/s)	0.0277	0.1483	0.7589	0.0383

Equation 3 - Estimating the time contaminant remains in atmosphere

$$Ec \div \frac{Q}{KV} = Tc$$

where:

Ec = Equilibrium Constant

Q/KV = Dispersion Constant

Tc = Time contaminant remains above the concentration of concern inside the cave

We calculated the time fog oil smoke from static training (Table 15) and mobile training (Table 16) will remain above safe levels in Indiana bat hibernacula. The concentration measured from the isopleths for static (Figures 14, 15, 16, and 17) and isopleths for mobile fog oil training (Figures 18, 19, 20, and 21) for Pasquill categories B, C, D, and E are presented for the inhalation pathway. We used the duration of smoke training events to determine the time required for fog oil to reach equilibrium within hibernacula, and for concentrations to be reduced to levels below a TRV or toxicity threshold. The concentration of fog oil that will reach the mouth of the cave is dependent upon distance between the source and the cave and Pasquill category. We performed similar analyses for the inhalation of TPA and titanium dioxide, using cave air flow models to determine stressor concentrations in caves and the amount of time the stressor would remain above toxicity levels.

We applied a similar method to estimate the dose Indiana bats in hibernacula would receive on their skin. We used deposition isopleths (Figures 22, and 23) to determine what stressor concentrations would reach the caves. Fog oil deposition isopleths for Pasquill categories B, C, and D are included in Attachment B.

8.3.2 Gray Bats

Gray bats at Fort Leonard Wood may be exposed to chemical stressors while foraging and roosting in maternity, transient, and bachelor caves. No bachelor caves have been identified on Fort Leonard Wood. We focused our analysis of effects to roosting bats on those individuals in maternity caves (Figure 24). Stressors may be ingested, inhaled, or dermally

TABLE 15. Parameters of models characterizing air flow in hibernacula, and estimated duration of concentrations above safe levels inside hibernacula calculated for Pasquill categories B - E for static smoke training*.

Caves (Exposure Sites) and Pasquill Categories	Distance (m) from source	Concentration of Fog Oil (g/m^3)	Min Mix Constant (K in 1/sec)	Equilibrium Value (g/m^3)	Acute X	Chronic X	Acute Y	Chronic Y	Q/KV	Acute time to Reduce Tox. (hrs)	Chronic time to Reduce Tox. (hrs)
Brooks B	6037	2.00E-04	0.03	0.03	1.3E+00	7.0E-05	-0.23	9.56	0.0099	-0.01	0.27
Brooks C	6037	5.00E-04	0.03	0.07	5.0E-01	2.8E-05	0.69	10.48	0.0099	0.02	0.29
Brooks D	6037	1.00E-03	0.03	0.15	2.5E-01	1.4E-05	1.38	11.17	0.0099	0.04	0.31
Brooks E	6037	2.00E-03	0.03	0.30	1.3E-01	7.0E-06	2.08	11.86	0.0099	0.06	0.33
Davis No. 2 Cave B	3927	1.00E-02	0.04	2.07	1.8E-02	1.0E-06	4.01	13.80	0.0035	0.32	1.10
Davis No. 2 Cave C	3927	1.00E-02	0.04	2.07	1.8E-02	1.0E-06	4.01	13.80	0.0035	0.32	1.10
Davis No. 2 Cave D	3927	5.00E-03	0.04	1.03	3.6E-02	2.0E-06	3.32	13.10	0.0035	0.26	1.04
Davis No. 2 Cave E	3927	1.00E-02	0.04	2.07	1.8E-02	1.0E-06	4.01	13.80	0.0035	0.32	1.10
Joy B	3682	1.00E-02	0.76	40.98	9.2E-04	5.1E-08	7.00	16.78	0.0054	0.36	0.86
Joy C	3682	1.00E-02	0.76	40.98	9.2E-04	5.1E-08	7.00	16.78	0.0054	0.36	0.86
Joy D	3682	5.00E-03	0.76	20.49	1.8E-03	1.0E-07	6.30	16.09	0.0054	0.32	0.83
Joy E	3682	1.00E-02	0.76	40.98	9.2E-04	5.1E-08	7.00	16.78	0.0054	0.36	0.86
Wolf Den B	3878	1.00E-02	0.15	8.01	4.7E-03	2.6E-07	5.36	15.15	0.0057	0.26	0.74
Wolf Den C	3878	1.00E-02	0.15	8.01	4.7E-03	2.6E-07	5.36	15.15	0.0057	0.26	0.74
Wolf Den D	3878	5.00E-03	0.15	4.00	9.4E-03	5.3E-07	4.67	14.46	0.0057	0.23	0.70
Wolf Den E	3878	1.00E-02	0.15	8.01	4.7E-03	2.6E-07	5.36	15.15	0.0057	0.26	0.74

*Based on training event lasting for 1.5 hours

The acute TRV is 0.04 g/kg and the Chronic TRV is 0.0000021 g/kg.

TABLE 16. Parameters of models characterizing air flow in hibernacula, and estimated duration of concentrations above safe levels inside hibernacula calculated for Pasquill categories B - E for mobile smoke training*.

Caves (Exposure Sites) and Pasquill Categories	Distance (m) from source	C (g/m^3)	Min Mix Constant (K in 1/sec)	Equilibrium Value (g/m^3)	Acute X	Chronic X	Acute Y	Chronic Y	*Q/KV*	Acute Time to Reduce Tox. (hrs)	Chronic Time to Reduce Tox. (hrs)
Musgrave Hollow											
Brooks Cave B	8031	1.00E-04	0.03	0.01	2.5E+00	1.4E-04	-0.92	8.87	0.0099	-0.03	0.25
Brooks Cave C	8031	2.00E-04	0.03	0.03	1.3E+00	7.0E-05	-0.23	9.56	0.0099	-0.01	0.27
Brooks Cave D	8031	5.00E-04	0.03	0.07	5.0E-01	2.8E-05	0.69	10.48	0.0099	0.02	0.29
Brooks Cave E	8031	1.00E-03	0.03	0.15	2.5E-01	1.4E-05	1.38	11.17	0.0099	0.04	0.31
Cannon Range (Mush Paddle)											
Brooks Cave B	10335	0.00E+00	0.03	0.00	0	0	0	0	0.0099	0	0
Brooks Cave C	10335	1.00E-04	0.03	0.01	2.5E+00	1.4E-04	-0.92	8.87	0.0099	-0.03	0.25
Brooks Cave D	10335	2.00E-04	0.03	0.03	1.3E+00	7.0E-05	-0.23	9.56	0.0099	-0.01	0.27
Brooks Cave E	10335	5.00E-04	0.03	0.07	5.0E-01	2.8E-05	0.69	10.48	0.0099	0.02	0.29
Bailey Hollow											
Brooks Cave B	5803	2.00E-04	0.03	0.03	1.3E+00	7.0E-05	-0.23	9.56	0.0099	-0.01	0.27
Brooks Cave C	5803	5.00E-04	0.03	0.07	5.0E-01	2.8E-05	0.69	10.48	0.0099	0.02	0.29
Brooks Cave D	5803	1.00E-03	0.03	0.15	2.5E-01	1.4E-05	1.38	11.17	0.0099	0.04	0.31
Brooks Cave E	5803	2.00E-03	0.03	0.30	1.3E-01	7.0E-06	2.08	11.86	0.0099	0.06	0.33
Ballard Hollow											
Brooks Cave B	8449	1.00E-04	0.03	0.01	2.5E+00	1.4E-04	-0.92	8.87	0.0099	-0.03	0.25
Brooks Cave C	8449	2.00E-04	0.03	0.03	1.3E+00	7.0E-05	-0.23	9.56	0.0099	-0.01	0.27
Brooks Cave D	8449	5.00E-04	0.03	0.07	5.0E-01	2.8E-05	0.69	10.48	0.0099	0.02	0.29
Brooks Cave E	8449	1.00E-03	0.03	0.15	2.5E-01	1.4E-05	1.38	11.17	0.0099	0.04	0.31
Musgrave Hollow											
Davis No. 2 Cave B	6624	2.00E-04	0.04	0.04	9.1E-01	5.1E-05	0.10	9.89	0.0035	0.01	0.78
Davis No. 2 Cave C	6624	2.00E-04	0.04	0.04	9.1E-01	5.1E-05	0.10	9.89	0.0035	0.01	0.78

Caves (Exposure Sites) and Pasquill Categories	Distance (m) from source	C (g/m^3)	Min Mix Constant (K in 1/sec)	Equilibrium Value (g/m^3)	Acute X	Chronic X	Acute Y	Chronic Y	*Q/KV*	Acute Time to Reduce Tox. (hrs)	Chronic Time to Reduce Tox. (hrs)
Davis No. 2 Cave D	6624	5.00E-04	0.04	0.10	3.6E-01	2.0E-05	1.01	10.80	0.0035	0.08	0.86
Davis No. 2 Cave E	6624	2.00E-03	0.04	0.41	9.1E-02	5.1E-06	2.40	12.19	0.0035	0.19	0.97
Cannon Range (Mush Paddle)											
Davis No. 2 Cave B	2889	1.00E-02	0.04	2.07	1.8E-02	1.0E-06	4.01	13.80	0.0035	0.32	1.10
Davis No. 2 Cave C	2889	1.00E-02	0.04	2.07	1.8E-02	1.0E-06	4.01	13.80	0.0035	0.32	1.10
Davis No. 2 Cave D	2889	5.00E-03	0.04	1.03	3.6E-02	2.0E-06	3.32	13.10	0.0035	0.26	1.04
Davis No. 2 Cave E	2889	1.00E-02	0.04	2.07	1.8E-02	1.0E-06	4.01	13.80	0.0035	0.32	1.10
Bailey Hollow											
Davis No. 2 Cave B	2423	1.00E-02	0.04	2.07	1.8E-02	1.0E-06	4.01	13.80	0.0035	0.32	1.10
Davis No. 2 Cave C	2423	1.00E-02	0.04	2.07	1.8E-02	1.0E-06	4.01	13.80	0.0035	0.32	1.10
Davis No. 2 Cave D	2423	5.00E-03	0.04	1.03	3.6E-02	2.0E-06	3.32	13.10	0.0035	0.26	1.04
Davis No. 2 Cave E	2423	1.00E-02	0.04	2.07	1.8E-02	1.0E-06	4.01	13.80	0.0035	0.32	1.10
Ballard Hollow											
Davis No. 2 Cave B	13352	0.00E+00	0.04	0.00	0	0	0	0	0.0035	0	0
Davis No. 2 Cave C	13352	1.00E-04	0.04	0.02	1.8E+00	1.0E-04	-0.59	9.19	0.0035	-0.05	0.73
Davis No. 2 Cave D	13352	2.00E-04	0.04	0.04	9.1E-01	5.1E-05	0.10	9.89	0.0035	0.01	0.78
Davis No. 2 Cave E	13352	5.00E-04	0.04	0.10	3.6E-01	2.0E-05	1.01	10.80	0.0035	0.08	0.86
Musgrave Hollow											
Joy Cave B	5499	2.00E-04	0.76	0.82	4.6E-02	2.6E-06	3.08	12.87	0.0054	0.16	0.66
Joy Cave C	5499	5.00E-04	0.76	2.05	1.8E-02	1.0E-06	4.00	13.79	0.0054	0.21	0.71
Joy Cave D	5499	1.00E-03	0.76	4.10	9.2E-03	5.1E-07	4.69	14.48	0.0054	0.24	0.74
Joy Cave E	5499	2.00E-03	0.76	8.20	4.6E-03	2.6E-07	5.39	15.17	0.0054	0.28	0.78
Cannon Range (Mush Paddle)											
Joy Cave B	1803	1.00E-02	0.76	40.98	9.2E-04	5.1E-08	7.00	16.78	0.0054	0.36	0.86
Joy Cave C	1803	1.00E-02	0.76	40.98	9.2E-04	5.1E-08	7.00	16.78	0.0054	0.36	0.86

Caves (Exposure Sites) and Pasquill Categories	Distance (m) from source	C (g/m^3)	Min Mix Constant (K in 1/sec)	Equilibrium Value (g/m^3)	Acute X	Chronic X	Acute Y	Chronic Y	*Q/KV*	Acute Time to Reduce Tox. (hrs)	Chronic Time to Reduce Tox. (hrs)
Joy Cave D	1803	1.00E-02	0.76	40.98	9.2E-04	5.1E-08	7.00	16.78	0.0054	0.36	0.86
Joy Cave E	1803	1.00E-02	0.76	40.98	9.2E-04	5.1E-08	7.00	16.78	0.0054	0.36	0.86
Bailey Hollow											
Joy Cave B	2045	1.00E-02	0.76	40.98	9.2E-04	5.1E-08	7.00	16.78	0.0054	0.36	0.86
Joy Cave C	2045	1.00E-02	0.76	40.98	9.2E-04	5.1E-08	7.00	16.78	0.0054	0.36	0.86
Joy Cave D	2045	5.00E-03	0.76	20.49	1.8E-03	1.0E-07	6.30	16.09	0.0054	0.32	0.83
Joy Cave E	2045	1.00E-02	0.76	40.98	9.2E-04	5.1E-08	7.00	16.78	0.0054	0.36	0.86
Ballard Hollow											
Joy Cave B	13821	0.00E+00	0.76	0.00	0	0	0	0	0.0054	0	0
Joy Cave C	13821	1.00E-04	0.76	0.41	9.2E-02	5.1E-06	2.39	12.18	0.0054	0.12	0.63
Joy Cave D	13821	2.00E-04	0.76	0.82	4.6E-02	2.6E-06	3.08	12.87	0.0054	0.16	0.66
Joy Cave E	13821	5.00E-04	0.76	2.05	1.8E-02	1.0E-06	4.00	13.79	0.0054	0.21	0.71
Musgrave Hollow											
Wolf Den Cave B	8609	1.00E-04	0.15	0.08	4.7E-01	2.6E-05	0.76	10.55	0.0057	0.04	0.51
Wolf Den Cave C	8609	2.00E-04	0.15	0.16	2.3E-01	1.3E-05	1.45	11.24	0.0057	0.07	0.55
Wolf Den Cave D	8609	5.00E-04	0.15	0.40	9.4E-02	5.3E-06	2.37	12.16	0.0057	0.12	0.59
Wolf Den Cave E	8609	1.00E-03	0.15	0.80	4.7E-02	2.6E-06	3.06	12.85	0.0057	0.15	0.63
Cannon Range (Mush Paddle)											
Wolf Den Cave B	8432	1.00E-04	0.15	0.08	4.7E-01	2.6E-05	0.76	10.55	0.0057	0.04	0.51
Wolf Den Cave C	8432	2.00E-04	0.15	0.16	2.3E-01	1.3E-05	1.45	11.24	0.0057	0.07	0.55
Wolf Den Cave D	8432	5.00E-04	0.15	0.40	9.4E-02	5.3E-06	2.37	12.16	0.0057	0.12	0.59
Wolf Den Cave E	8432	1.00E-03	0.15	0.80	4.7E-02	2.6E-06	3.06	12.85	0.0057	0.15	0.63
Bailey Hollow											
Wolf Den Cave B	3861	1.00E-02	0.15	8.01	4.7E-03	2.6E-07	5.36	15.15	0.0057	0.26	0.74
Wolf Den Cave C	3861	1.00E-03	0.15	0.80	4.7E-02	2.6E-06	3.06	12.85	0.0057	0.15	0.63
Wolf Den Cave D	3861	2.00E-03	0.15	1.60	2.3E-02	1.3E-06	3.75	13.54	0.0057	0.18	0.66

Caves (Exposure Sites) and Pasquill Categories	Distance (m) from source	C (g/m^3)	Min Mix Constant (K in 1/sec)	Equilibrium Value (g/m^3)	Acute X	Chronic X	Acute Y	Chronic Y	*Q/KV*	Acute Time to Reduce Tox. (hrs)	Chronic Time to Reduce Tox. (hrs)
Wolf Den Cave E	3861	5.00E-03	0.15	4.00	9.4E-03	5.3E-07	4.67	14.46	0.0057	0.23	0.70
Bailey Hollow											
Wolf Den Cave B	6859	2.00E-04	0.15	0.16	2.3E-01	1.3E-05	1.45	11.24	0.0057	0.07	0.55
Wolf Den Cave C	6859	2.00E-04	0.15	0.16	2.3E-01	1.3E-05	1.45	11.24	0.0057	0.07	0.55
Wolf Den Cave D	6859	5.00E-04	0.15	0.40	9.4E-02	5.3E-06	2.37	12.16	0.0057	0.12	0.59
Wolf Den Cave E	6859	2.00E-03	0.15	1.60	2.3E-02	1.3E-06	3.75	13.54	0.0057	0.18	0.66

*Based on training event lasting for 2.5 hours
*The acute TRV is 0.04 g/kg, Chronic TRV is 0.0000021 g/kg.

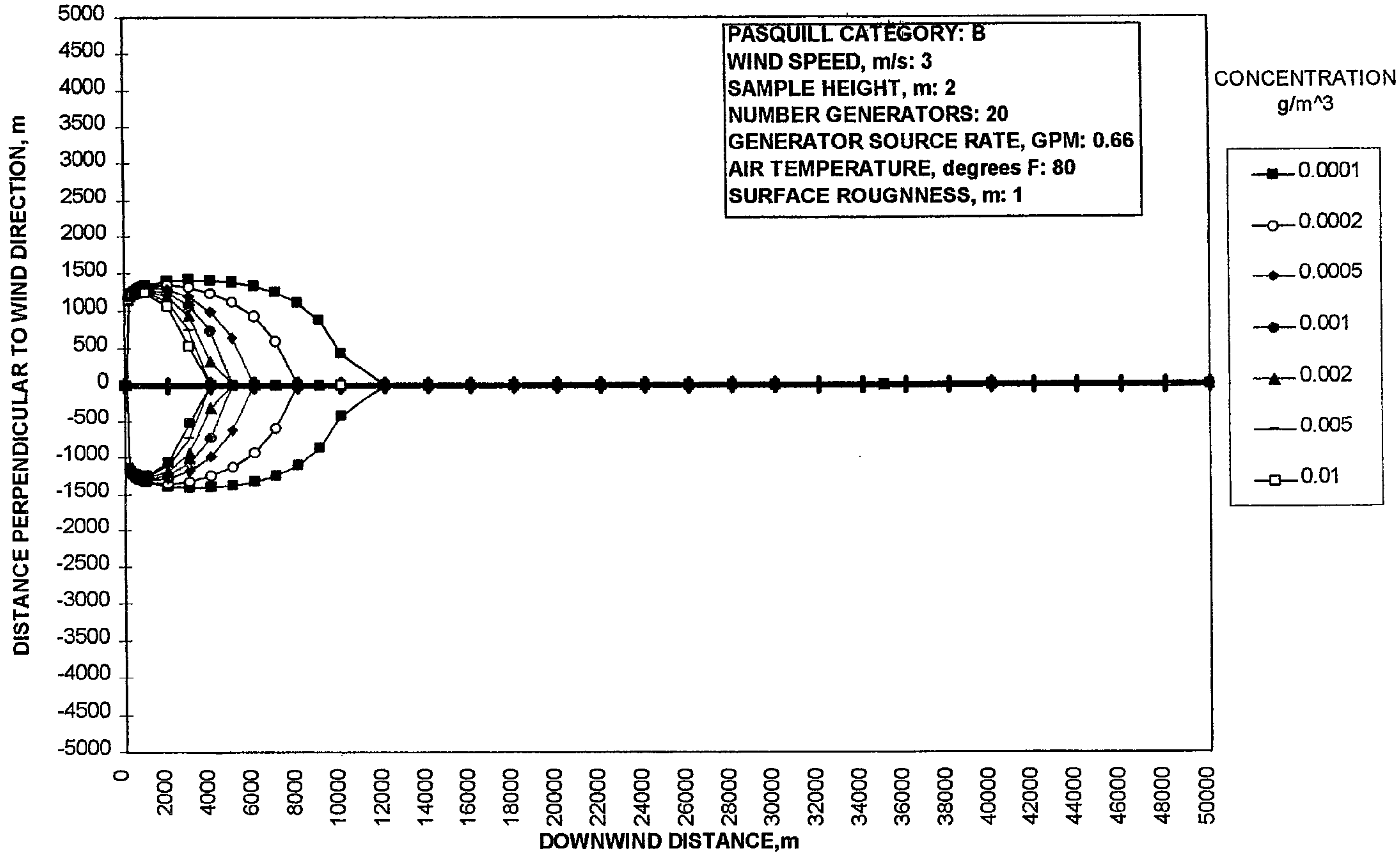


FIGURE 14. Concentration of fog oil smoke (Pasquill B) at varying distances from the static training area.

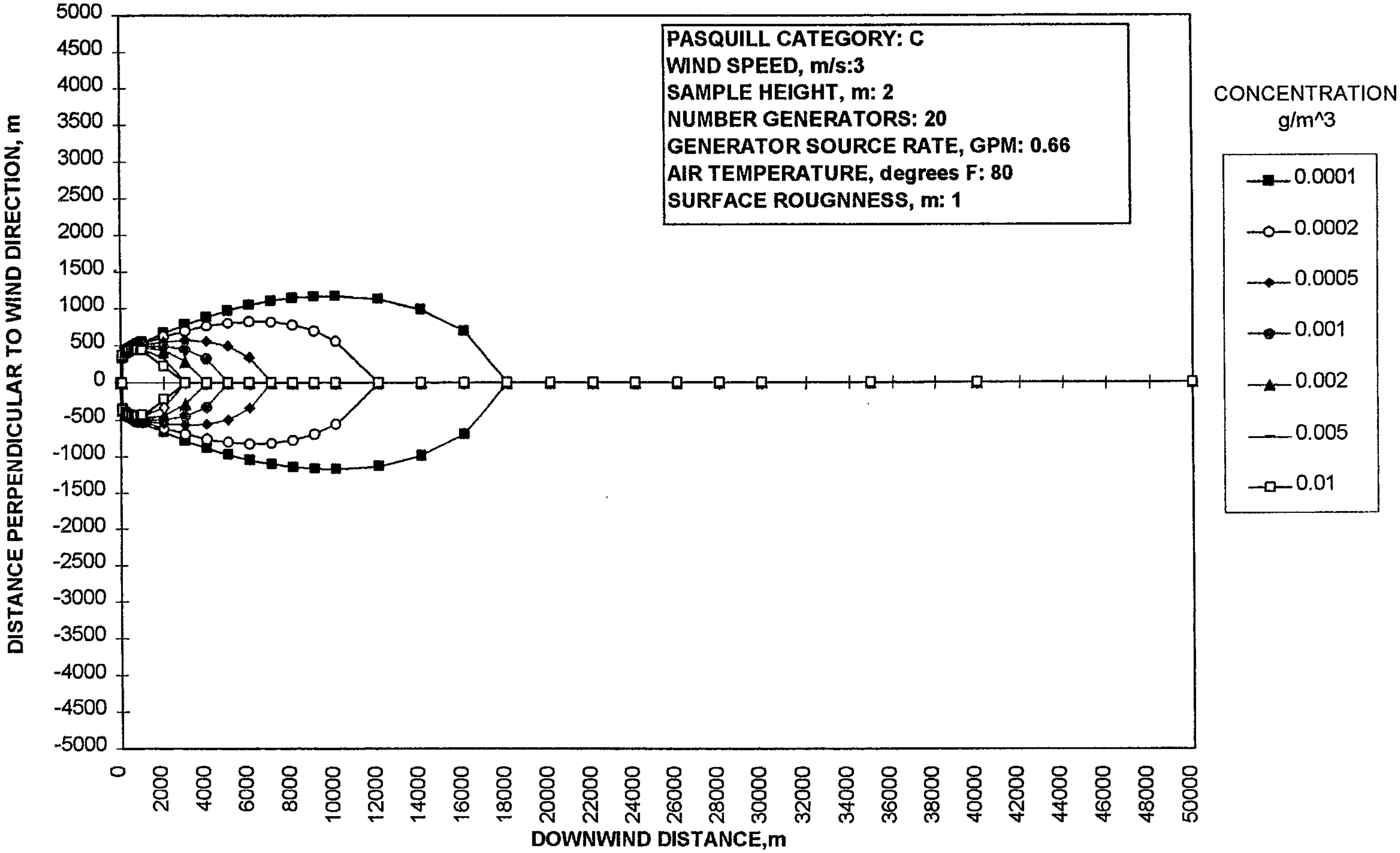


FIGURE 15. Concentration of fog oil smoke (Pasquill C) at varying distances from the static training area.

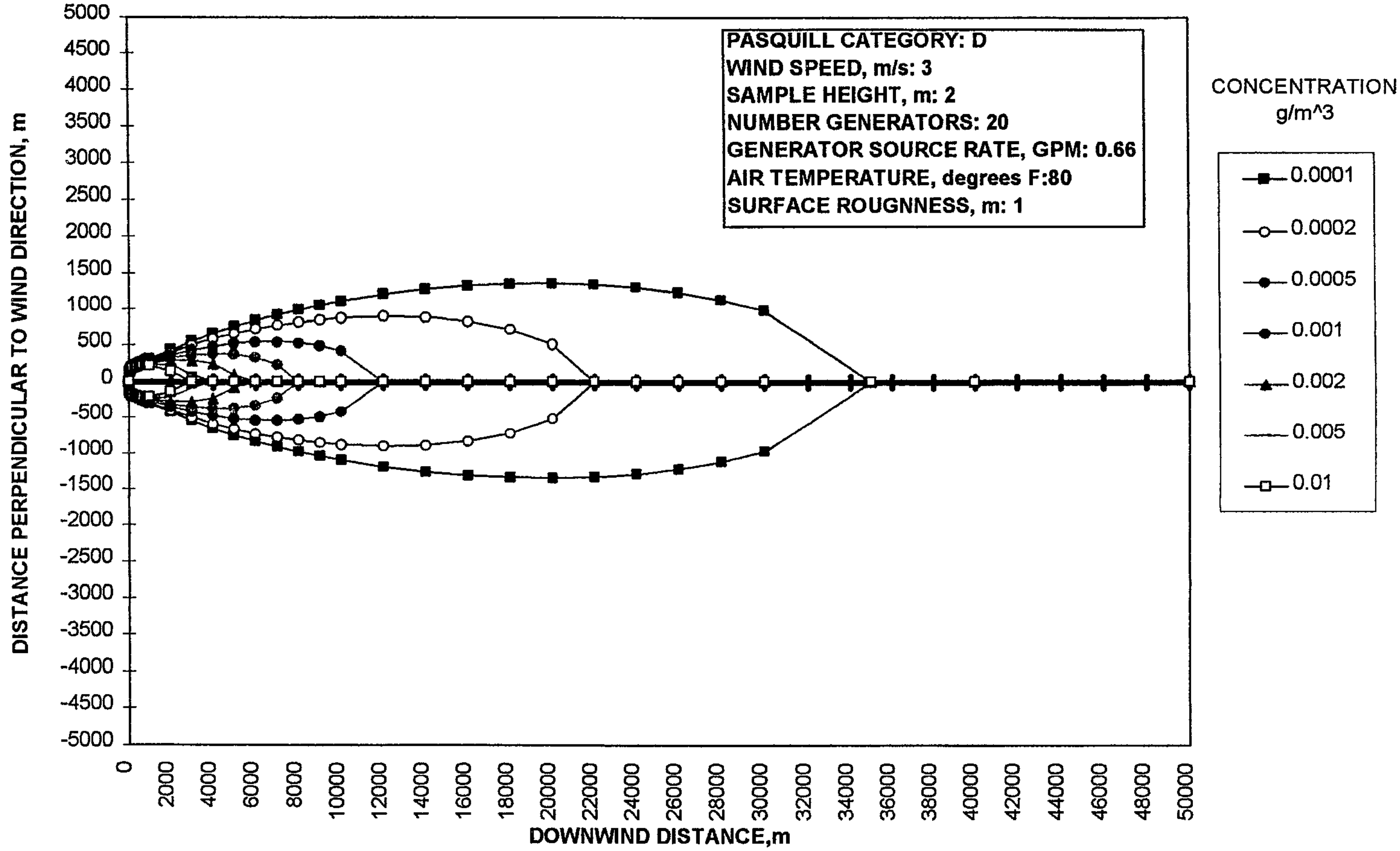


FIGURE 16. Concentration of fog oil smoke (Pasquill D) at varying distances from the static training area.

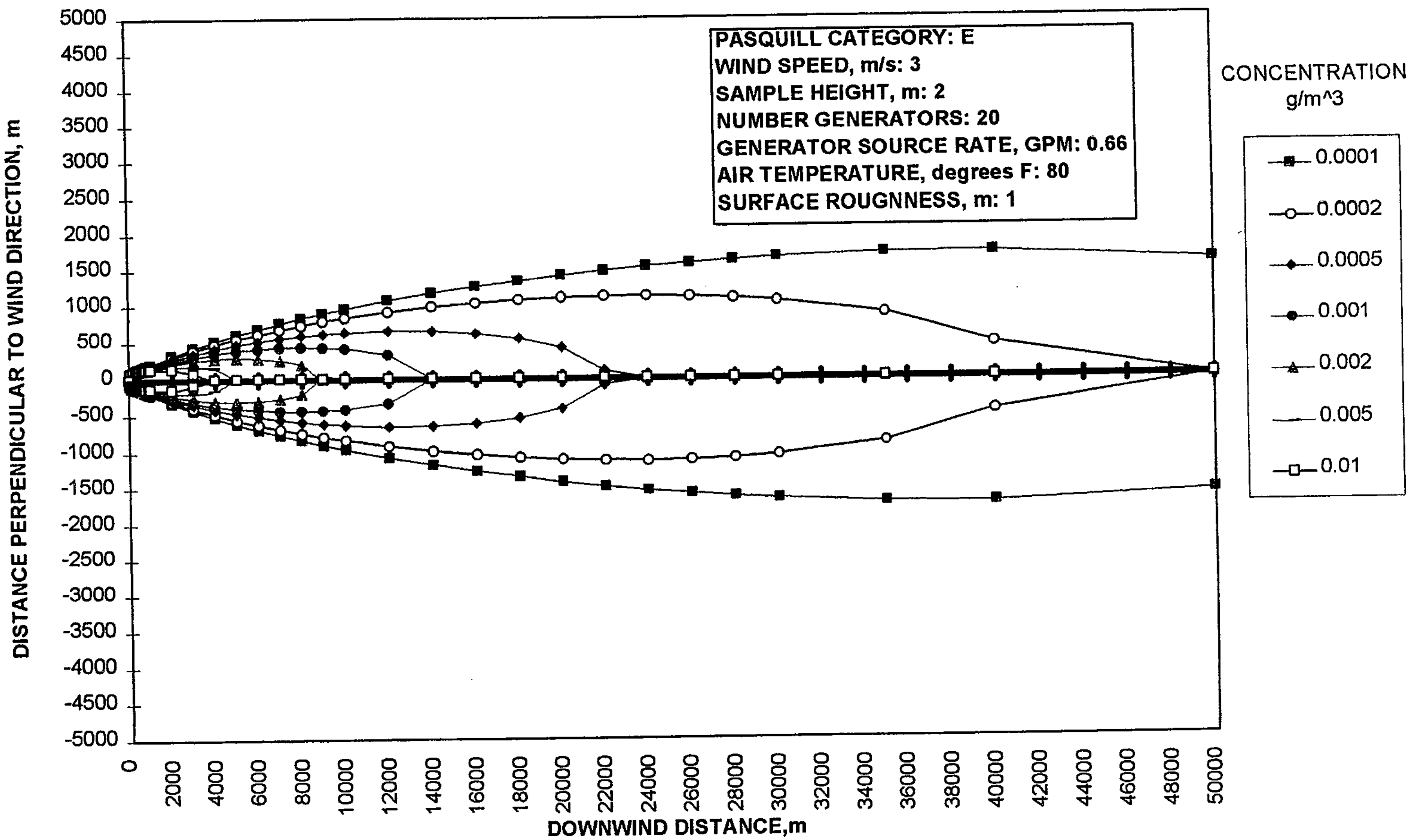


FIGURE 17. Concentration of fog oil smoke (Pasquill E) at varying distances from the static training area.

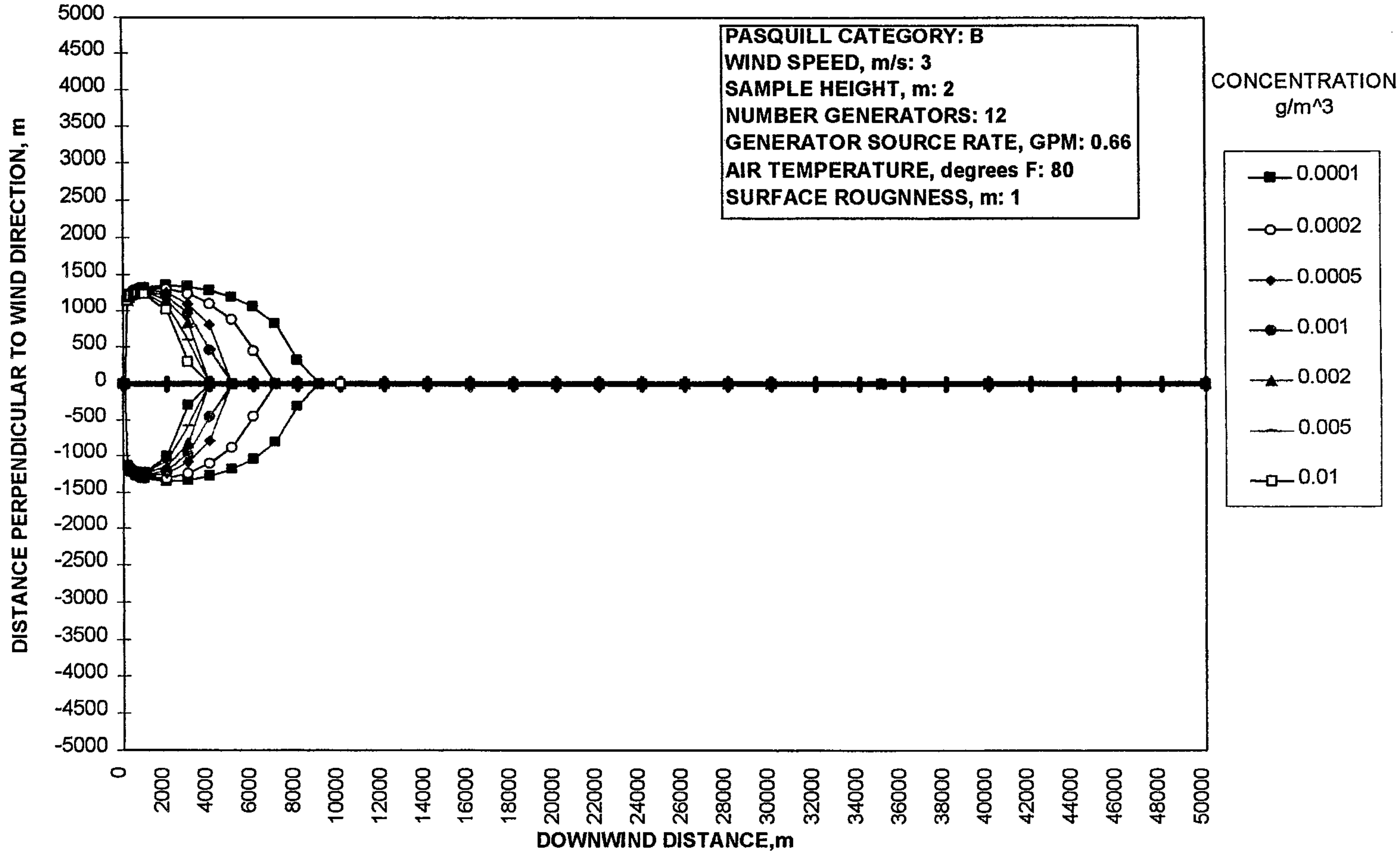


FIGURE 18. Concentration of fog oil smoke (Pasquill B) at varying distances from the mobile training areas.

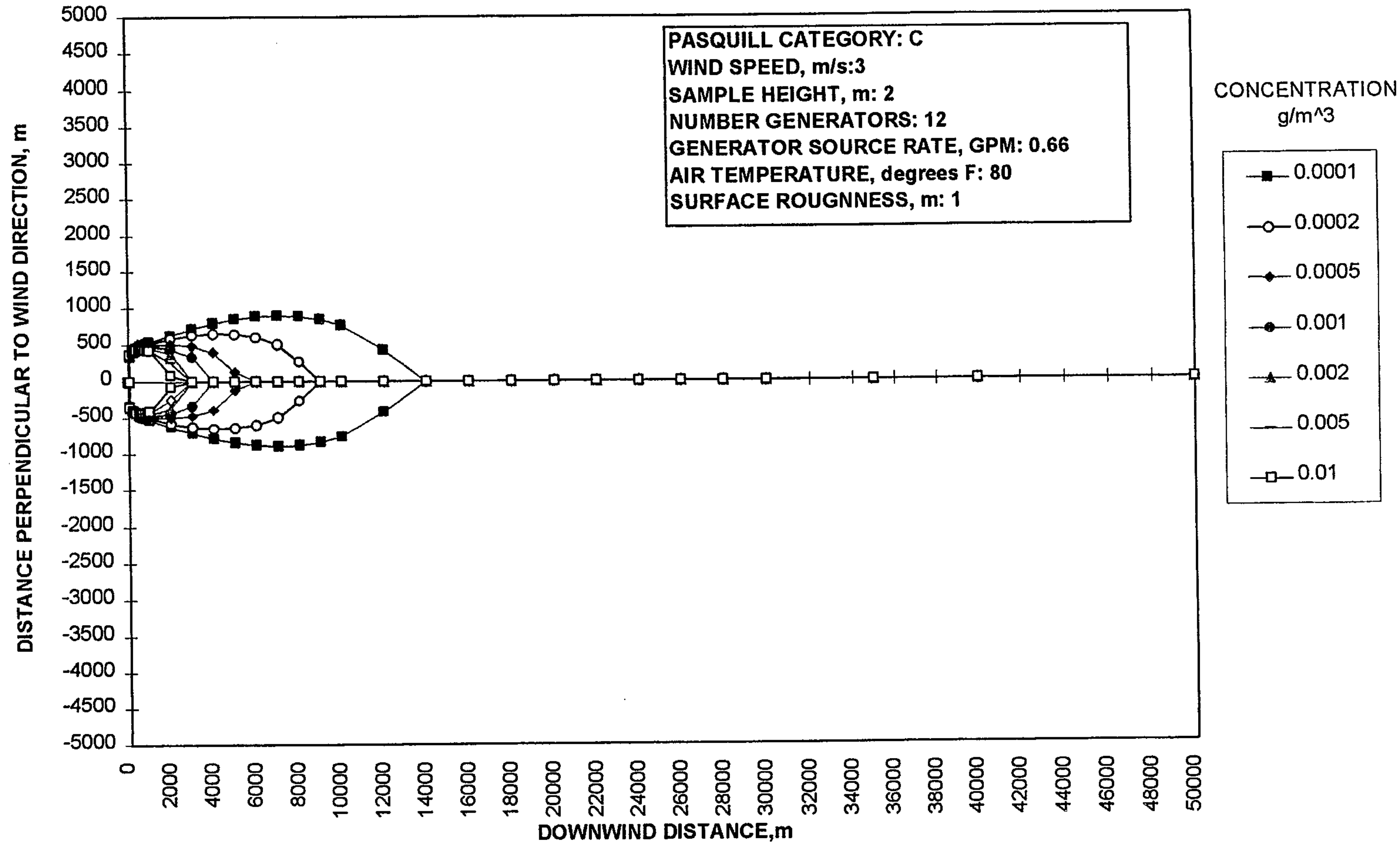


FIGURE 19. Concentration of fog oil smoke (Pasquill C) at varying distances from the mobile training areas.

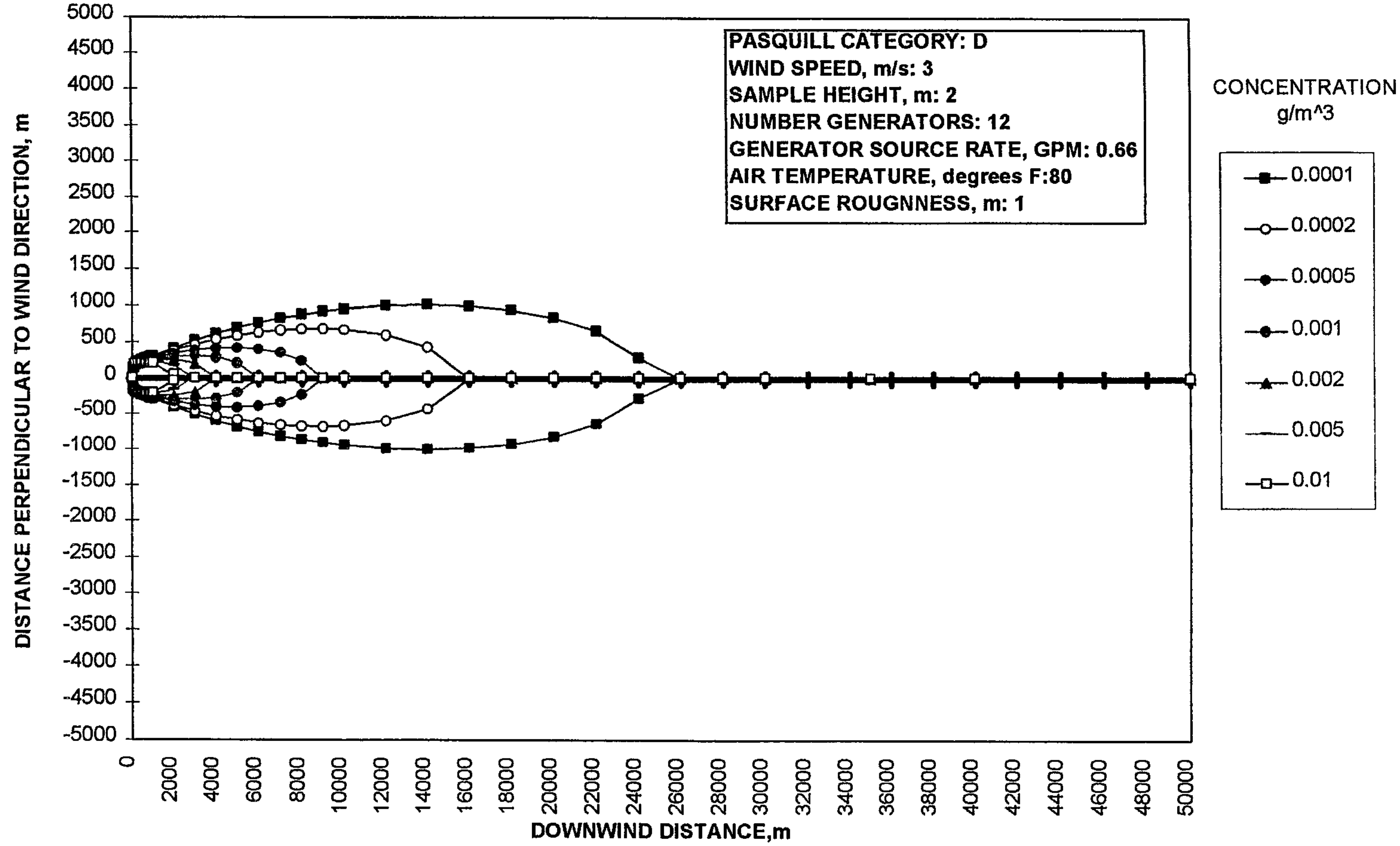


FIGURE 20. Concentration of fog oil smoke (Pasquill D) at varying distances from the mobile training areas.

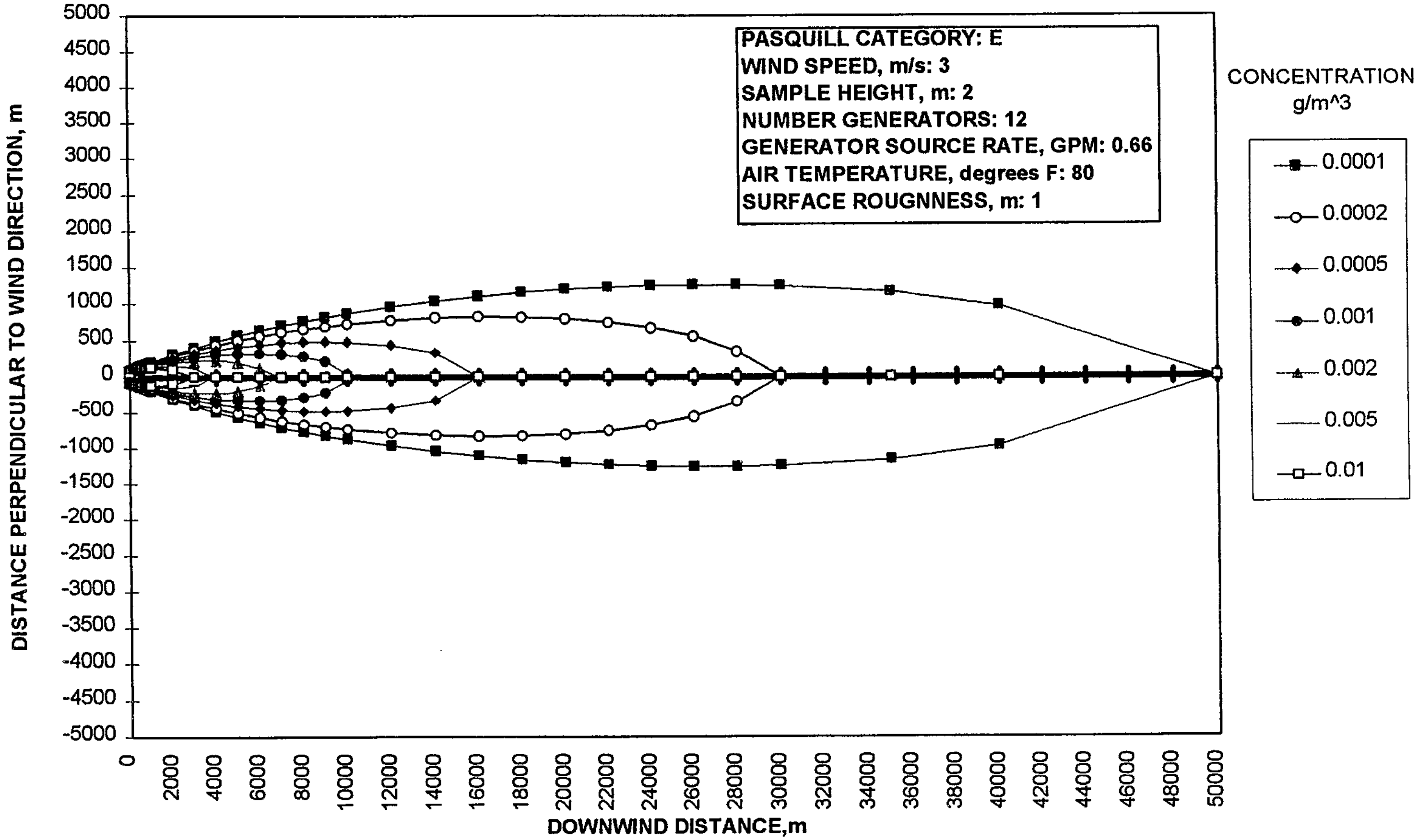


FIGURE 21. Concentration of fog oil smoke (Pasquill E) at varying distances from the mobile training areas.

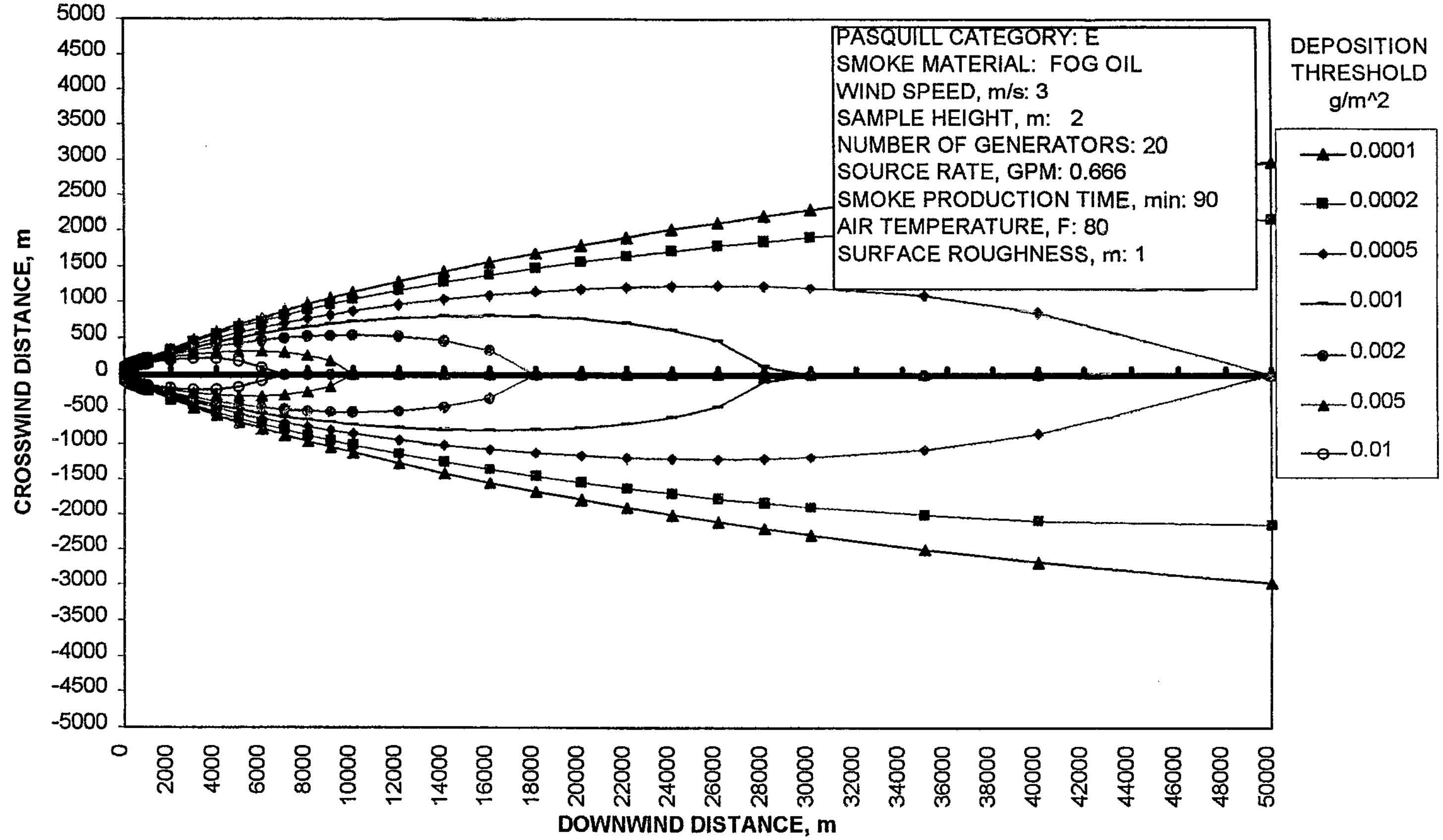


FIGURE 22. Deposition of fog oil smoke (Pasquill E) at varying distances from the static training area.

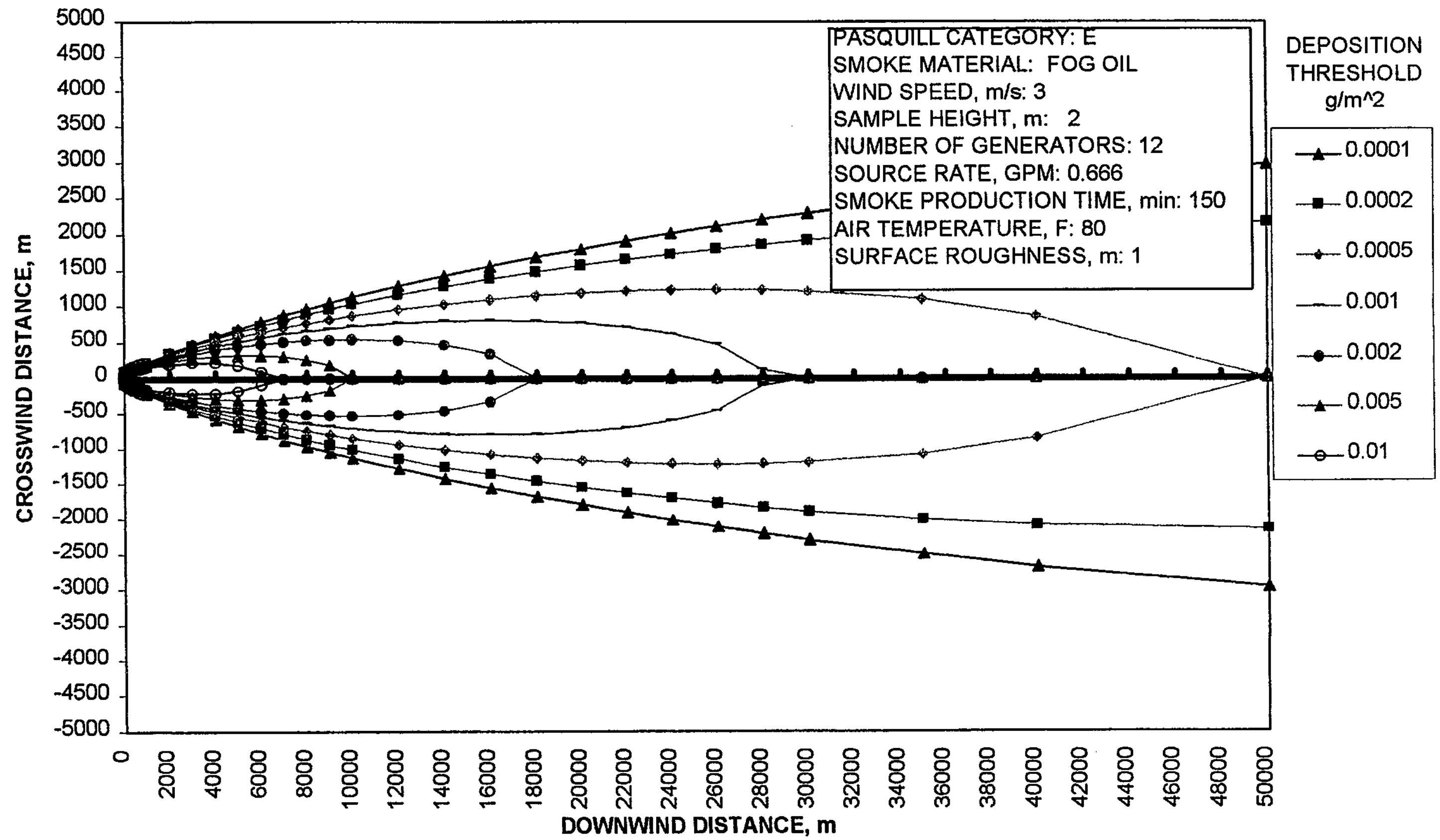


FIGURE 23. Deposition of fog oil smoke (Pasquill E) at varying distances from the mobile training areas.

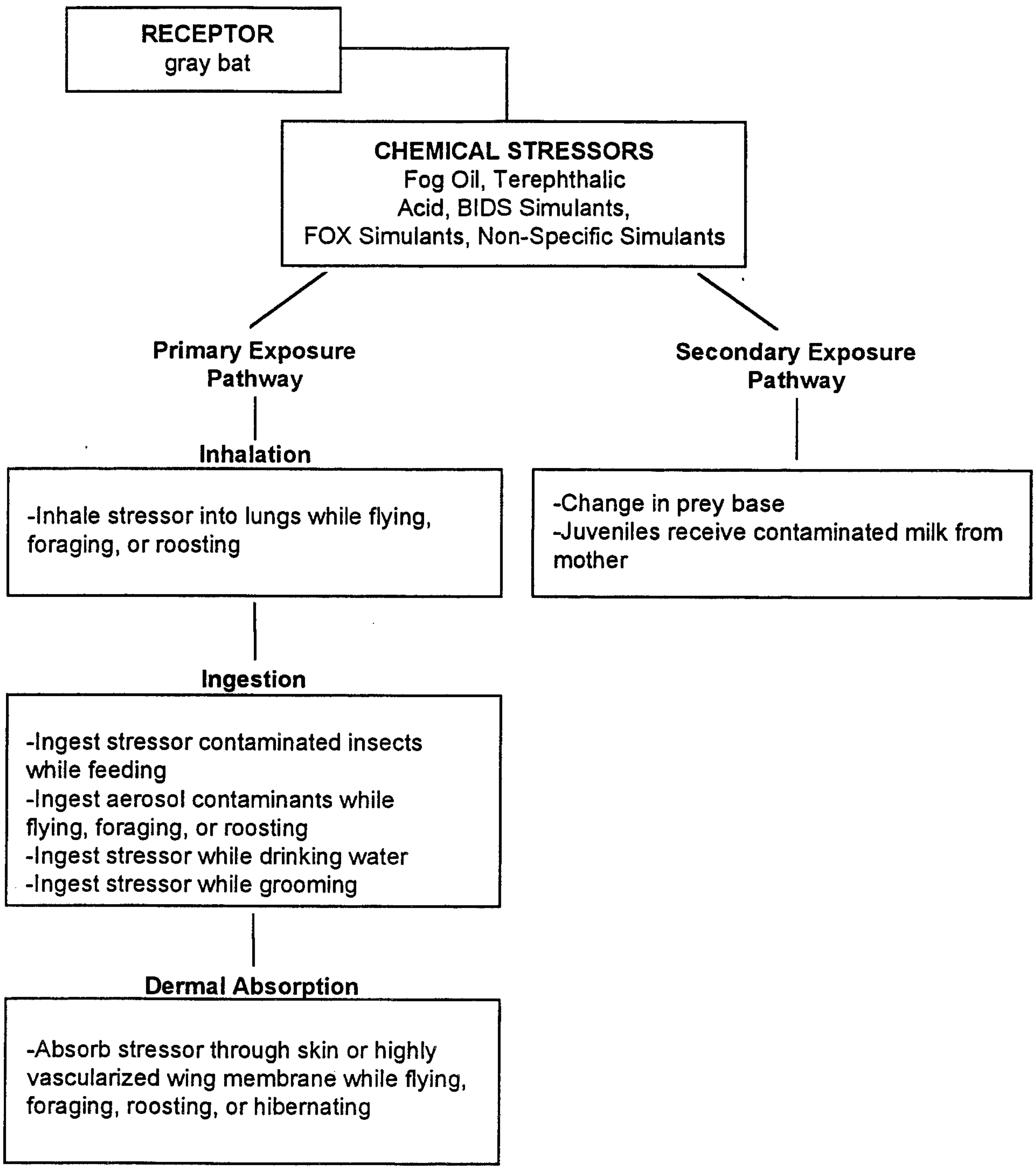


FIGURE 24. Pathways through which gray bats may be exposed to stressors at Fort Leonard Wood.

absorbed by gray bats. Gray bats have the potential for primary exposure to chemical stressors (directly to the organism) or secondary exposure (indirectly to the organism through another source).

8.3.2.1 Foraging Gray Bats

Gray bats normally forage over open water in forested riparian areas, and may fly almost installation-wide. Typical flight distances from roosts to foraging areas may be 12 to 13 km; distances as great as 35 km (Tuttle 1976) and 70 km (Thomas and Best, in press) have been documented. Adult gray bats primarily feed on aquatic insects (Figure 25). They forage from dusk to dawn, resting intermittently, and return to roost caves. Additional information regarding the foraging habits of gray bats is provided in Section 3.2.4 of this appendix.

8.3.2.2 Roosting Gray Bats

Gray bats are found on the Installation for approximately 5 months (late April - early September) each year. Saltpeter No. 3 and Freeman caves are within several hundred meters of a waterway. Additional information describing gray bats in maternity roosts is provided in Section 3.2.3. Gray bats also have maternity roosts Great Spirit Cave, approximately 3 km west of the Installation.

Gray Bat Maternity Sites

We assessed effects to gray bat in Saltpeter No. 3 and Freeman caves (Figure 26). We also assessed effects to gray bats in maternity roosts in Great Spirit Cave (Figure 26). No cave air flow model was developed for Great Spirit Cave. We assessed effects based on contaminant concentrations expected to reach the cave. Physical characteristics of caves can influence the behavior of stressors inside the caves. Stressors can persist or be rapidly removed from the cave atmosphere depending on the size and air flow dynamics of the cave. Table 17 provides physical descriptions for the caves on the installation.

The entrance to Saltpeter No. 3 Cave (3 m high and 28 m wide) faces east toward Roubidoux Creek. The large, domed entrance room (73 m long and 30 m wide) is used as a gray bat maternity site. Over 700 m of passage has been mapped beyond the entrance room. Gray bats roost in 3 areas beyond the entrance room during the maternity season.

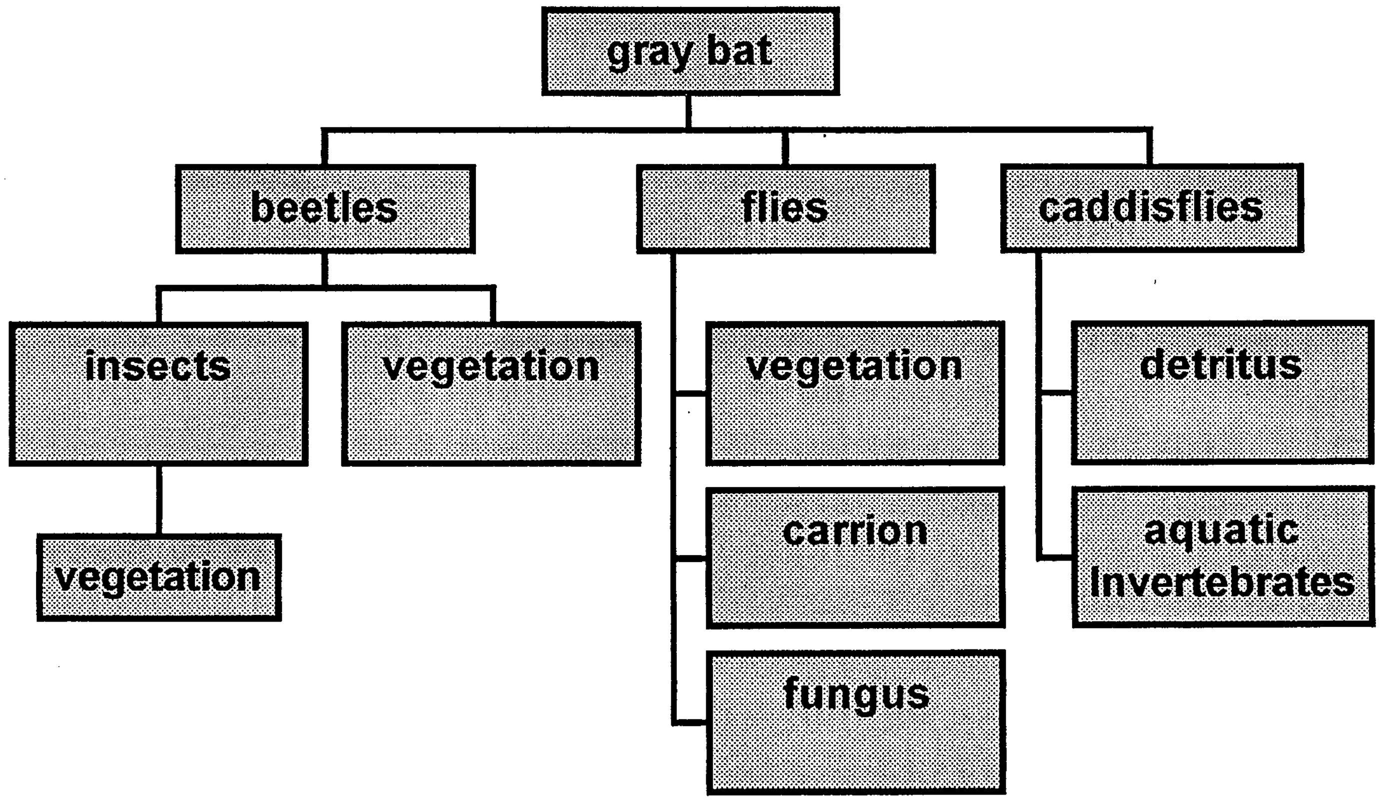
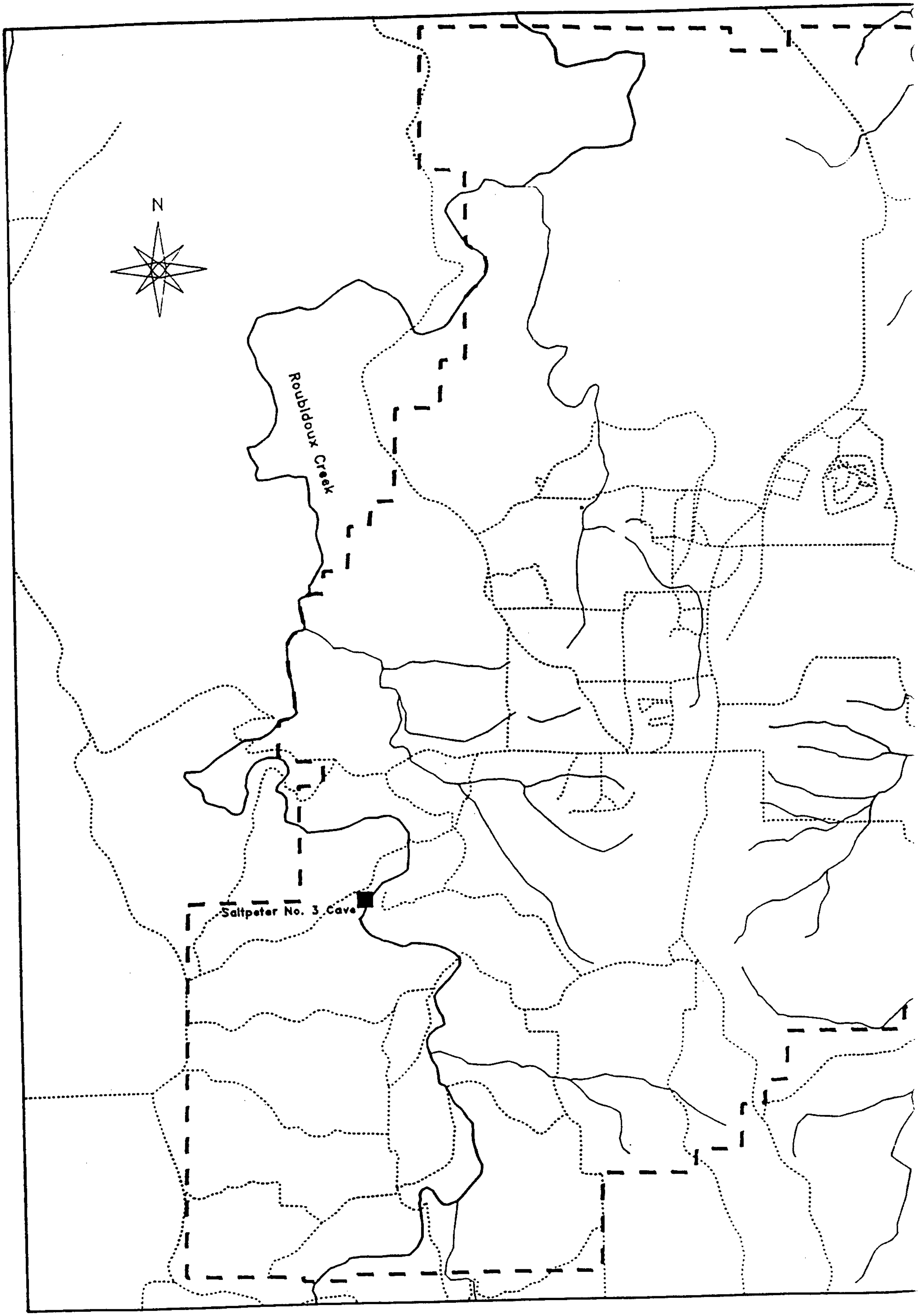


FIGURE 25. Food chain of gray bats at Fort Leonard Wood, Missouri.



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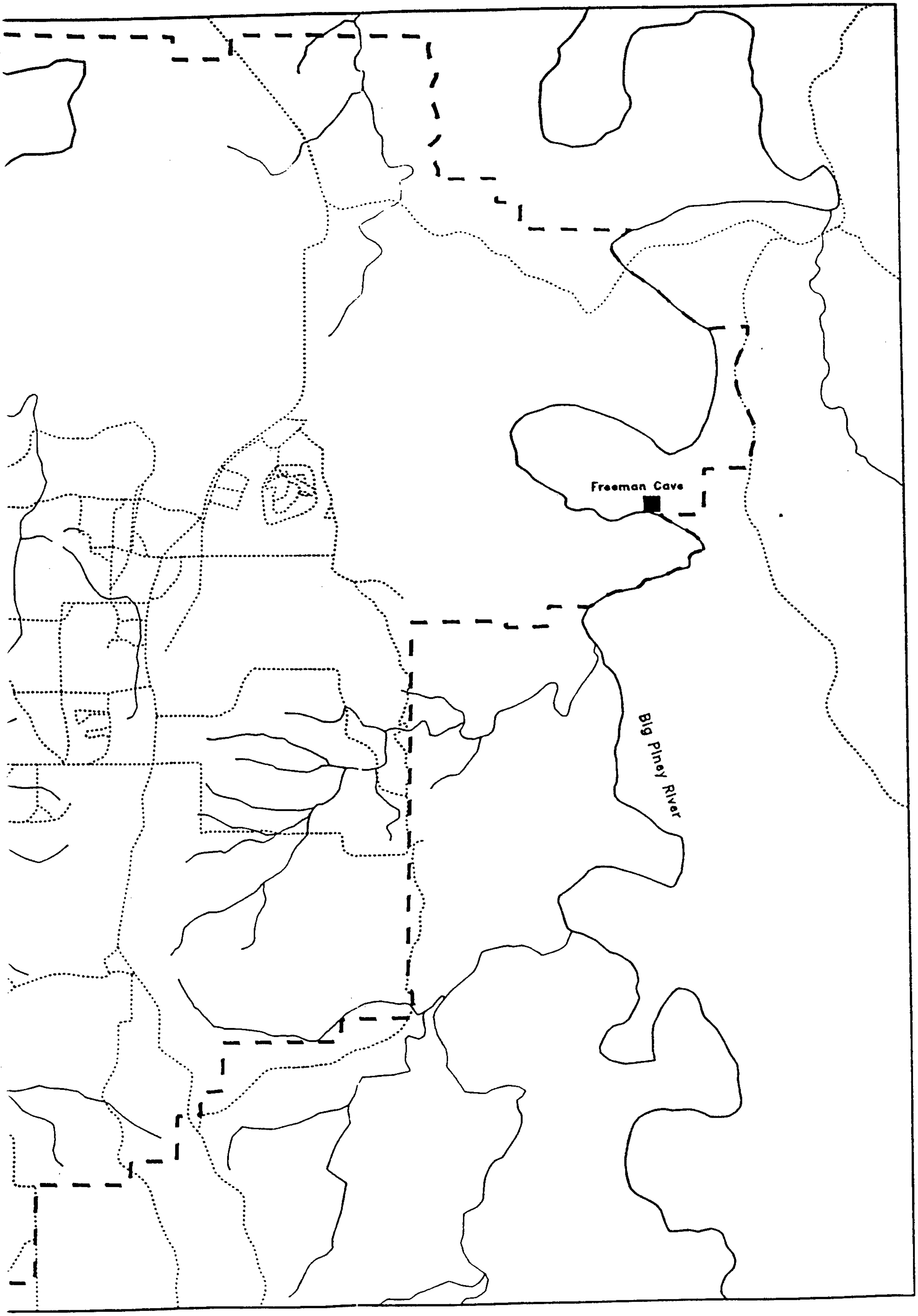

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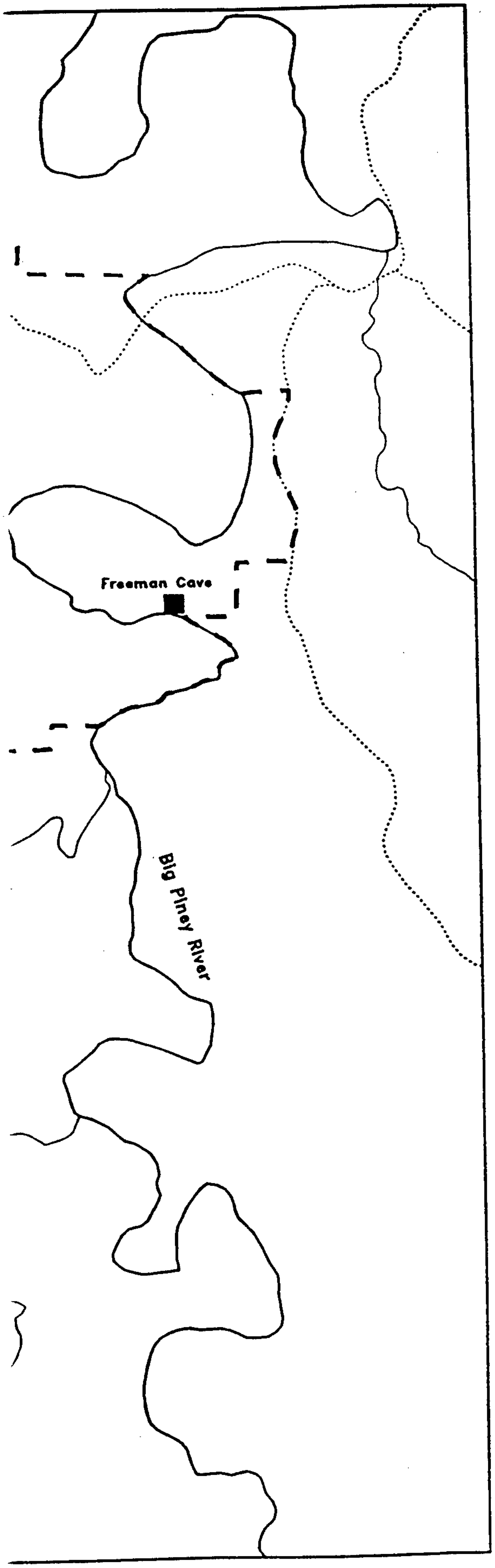

APPENDIX IV TO

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RELOCATION OF U.S. ARMY CHEMICAL SCHOOL AND MILITARY POLICE SCHOOL TO FORT LEONARD WOOD, MISSOURI

FIGURE 26. Gray bat caves at Fort Leonard Wood, Missouri.

■ Gray Bat Cave

Fort Leonard Wood Boundary

Road

River / Stream

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TABLE 17. Dimensions of gray bat caves on Fort Leonard Wood.

	Saltpeter No. 3	Freeman
Entrance area (ft^2)	506	1103
Cave volume (ft^3)	286,192	53,463
Entrance area/cave volume	5.80E-05	6.77E-04

Freeman Cave has a south-facing entrance 12 m high and 15 m wide. The cave floor slopes upward which contributes to the cave trapping warm air. The passage quickly narrows as the floor rises to create a passage 2 m high and 2.5 m wide. Approximately 40 m into the cave is a dome room approximately 15 m high. Gray bats roost on the ceiling of this dome room. The dome may trap the warmest air entering the cave and provide conditions suitable for a gray bat maternity colony. An upper passage runs from the top of the dome toward the cave entrance. A lower passage continues from the bottom of the dome room for another 30 m. Gray bats are not known to use the upper or lower passages, but the passages likely influence cave air flow.

Air Flow at Gray Bat Caves

We collected meteorological data from Saltpeter No. 3 and Freeman caves as we did for Indiana bat hibernacula (see Section 8.3.1.3). Table 18 presents mixing constants and air flow model values for Saltpeter No. 3 and Freeman caves. Pasquill categories and the stressor concentration associated with each category are included in Tables 15 and 16.

8.3.3 Bald Eagles

Bald eagles may ingest, inhale, or absorb stressors while perching, foraging, roosting, and nesting (Figure 27). Bald eagles have the potential for direct exposure to chemical stressors or secondary exposure (exposure to chemical stressors through another source). Figure 27 presents an exposure pathways for bald eagles at Fort Leonard Wood.

8.3.3.1 Wintering Bald Eagles

Bald eagles winter at Fort Leonard Wood from approximately November 1 through March 15. Bald eagles may be exposed to chemical stressors while perched, or while foraging

TABLE 18. Information used to develop air flow models for gray bat caves on Fort Leonard Wood, Missouri.

Parameter	Saltpeter No. 3 Cave	Freeman Cave
Cave maximum temperature (K)	290	289
Cave minimum temperature (K)	258	282
Cave maximum pressure (mbar)	1002	1002
Cave minimum pressure (mbar)	959	959
Maximum computed air velocity (1 mbar dP, cm/s)	41.6280	41.5561
Minimum computed air velocity (1 mbar dP, cm/s)	38.4124	40.1593
Maximum flow rate/cave volume (1/s)	0.0024	0.0281
Minimum flow rate/cave volume (1/s)	0.0022	0.0271
Measured dispersion constant range (Q/KV)	0.0011-0.0007	0.0029-0.0018
Highest correlation dispersion constant	0.0007	0.0029
Maximum mixing constant (1/s)	3.4496	9.6993
Minimum mixing constant (1/s)	3.1831	9.3733

in the winter. Wintering bald eagles perch along Roubidoux Creek and the Big Piney River on the installation (Figure 28). Eagles roost at night in areas sheltered from extreme weather and human disturbance. Typical night roosts are in mature trees with heavy limbs and an open branching pattern. Wintering bald eagle roost trees are of various species, but are typically large and sheltered from prevailing winds. Bald eagles may change roost sites every 3 to 4 nights. Wintering eagles are not known to roost communally on the installation. No night roosts have been identified.

Bald eagles migrate to winter habitat in response to adverse weather conditions and limited food availability. Winter habitats typically are near readily available food resources. The diet of wintering bald eagles consists primarily of carrion, waterfowl, and dead or dying fish (Figure 29). The winter diet varies with the type of food most readily available. Winter foraging areas and diurnal foraging perches often are near streams, lakes, or other water bodies. Section 3.3.3 of this appendix provides a more detailed description of the life history of the species.

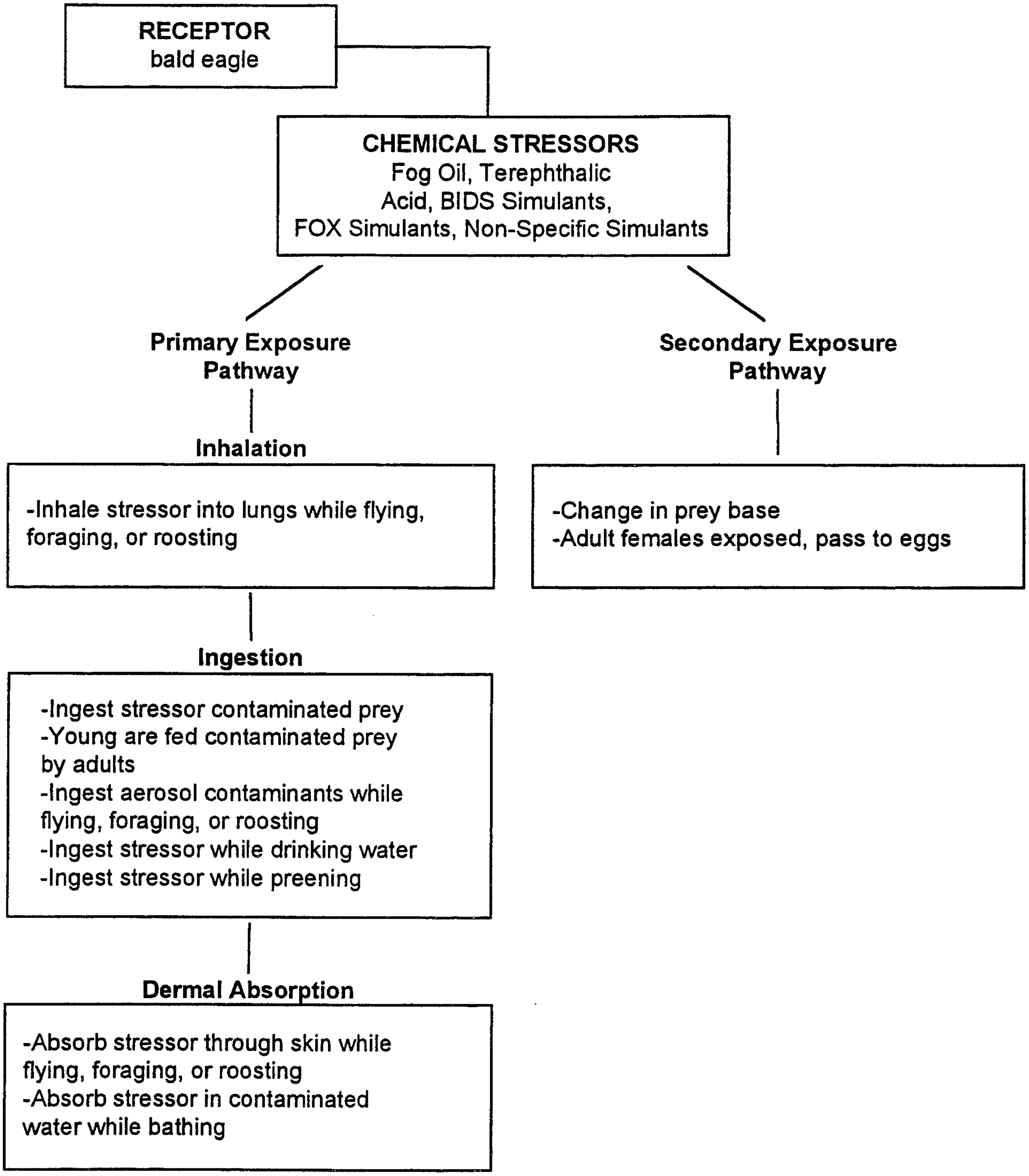
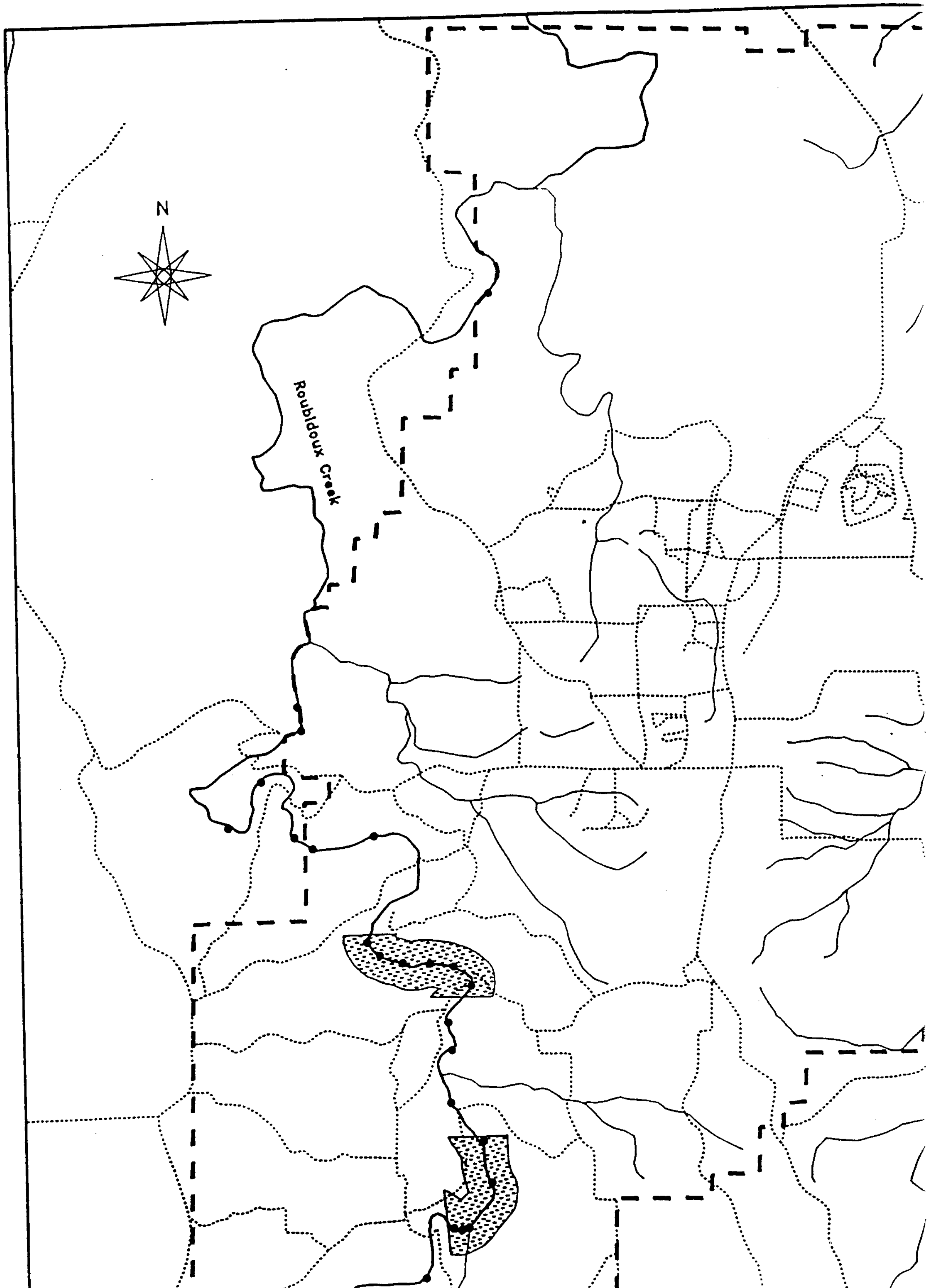


FIGURE 27. Pathways through which bald eagles may be exposed to stressors at Fort Leonard Wood.



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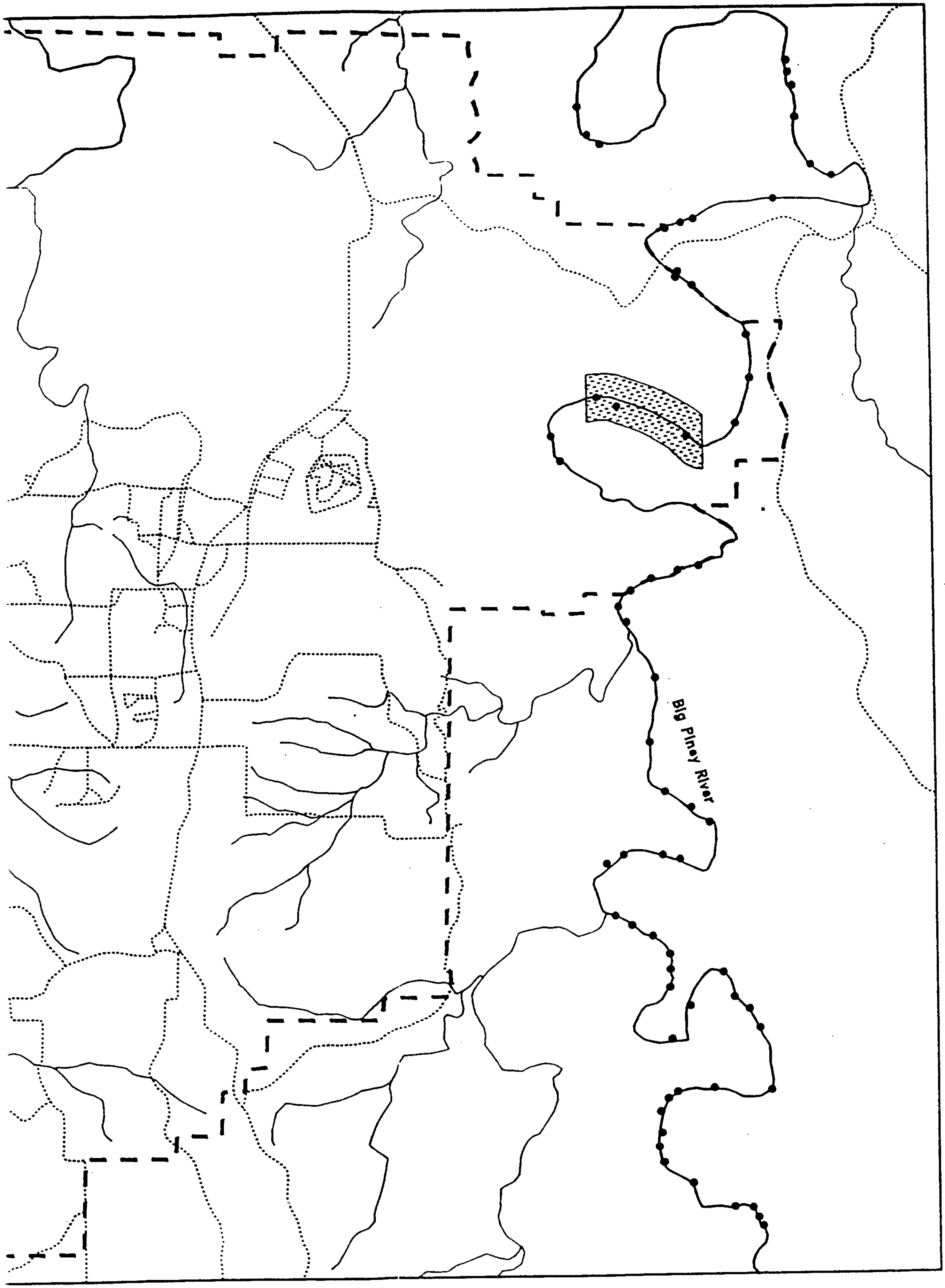

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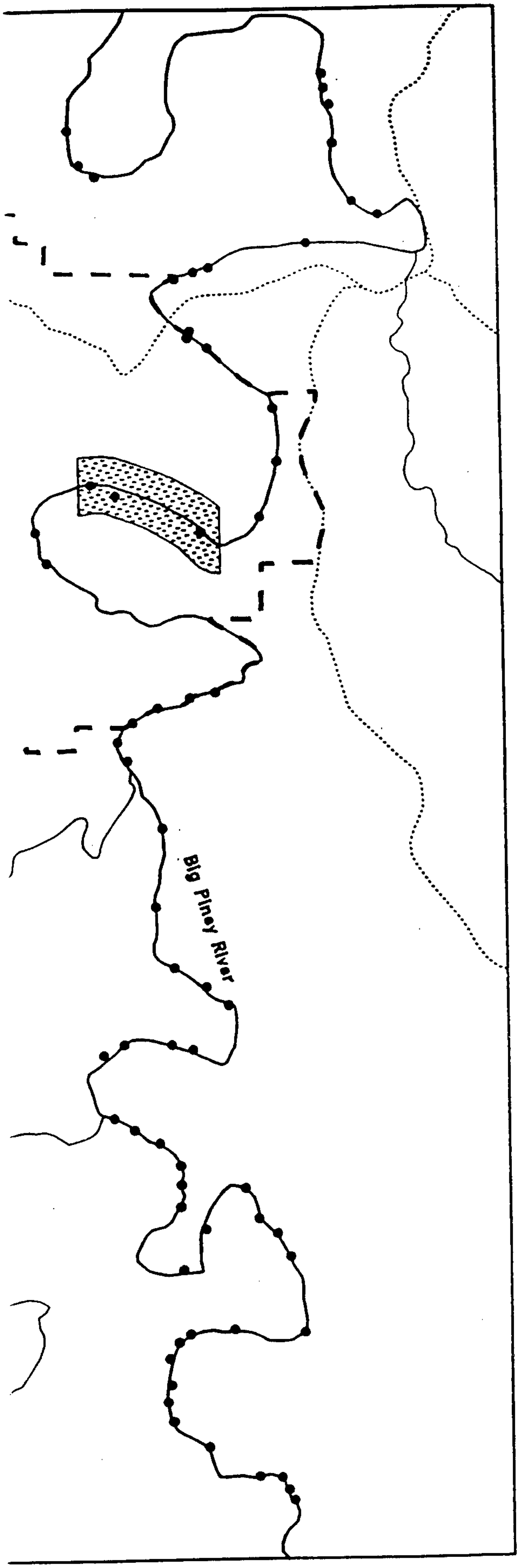

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FIGURE 28. Bald eagle sightings, and concentration areas in which 10 or more eagles have been sighted within a 2 Km stretch of Roubidoux Creek or Big Piney River between 1988 and 1995.

- ● Bald Eagle Sighting
- Bald Eagle Concentration Area
- Fort Leonard Wood Boundary
- ········ Road
- —— River / Stream

Kilometers

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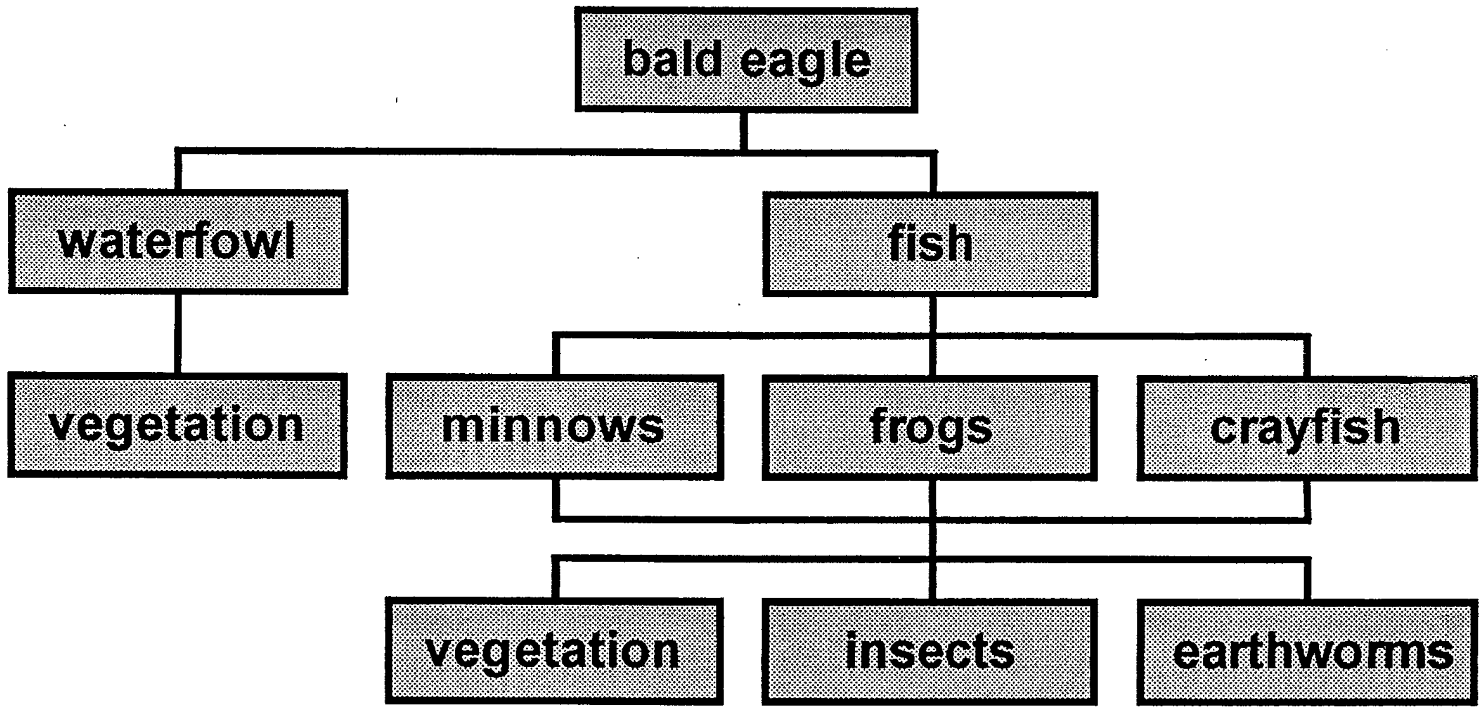


FIGURE 29. Food chain of bald eagles at Fort Leonard Wood, Missouri.

8.3.3.2 Nesting Bald Eagles

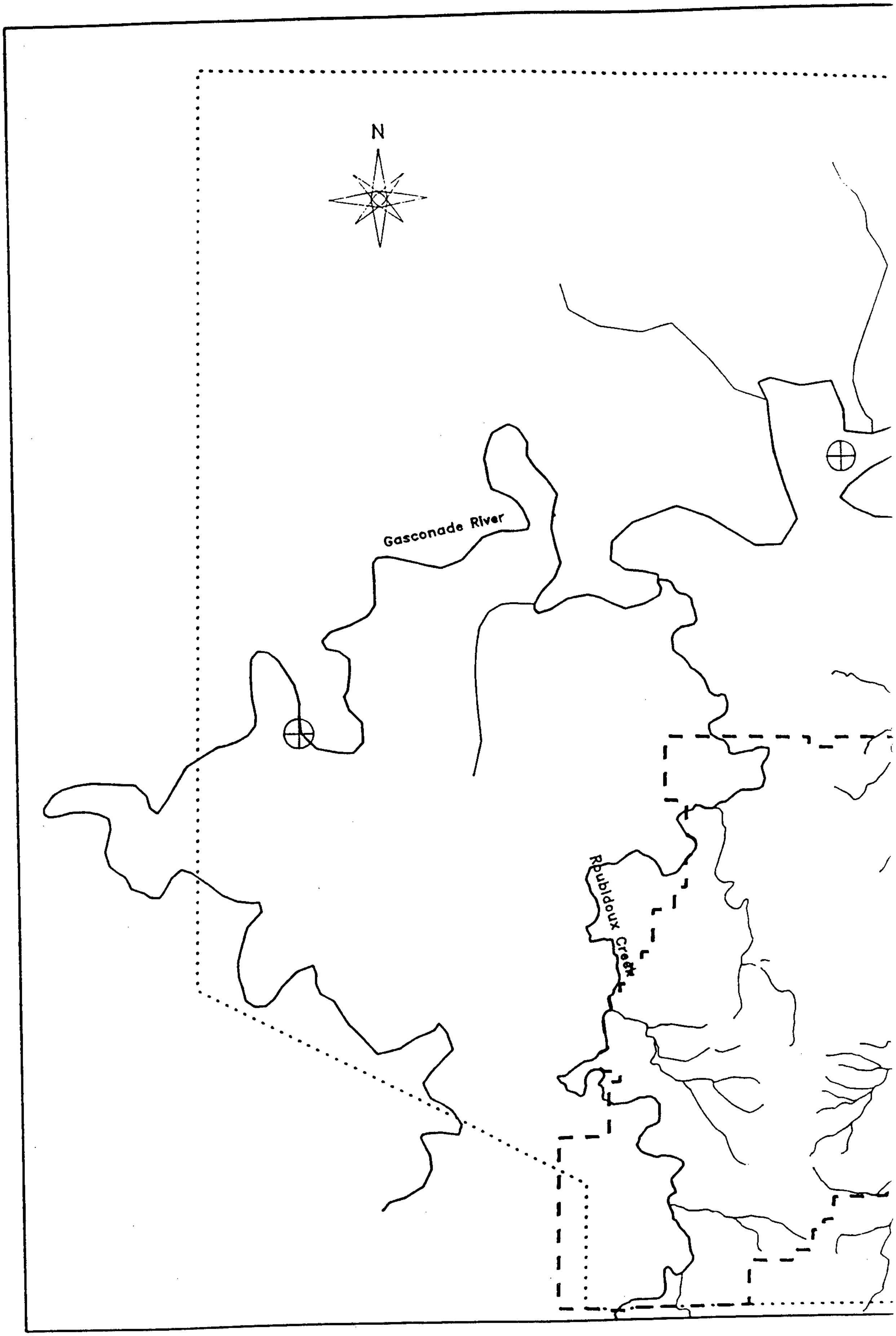
Bald eagles nest near Fort Leonard Wood. Three active nests are known along the Gasconade River near the installation (Figure 30), with the nearest nest 10.4 km from the installation boundary. Nesting bald eagles near the Installation feed largely upon fish, waterfowl, and carrion. The reproduction period of bald eagles varies with latitude. In Missouri, the onset of nesting behavior can be expected from January through early March. Nesting is not synchronized among sympatric eagles. The time period from the beginning of egg laying through juvenile independence can range from 164 - 214 days, and nesting eagles may be present near Fort Leonard Wood for much of the year. The average lifespan for bald eagles is 35 years.

Nesting bald eagle occupy home range that average 321 acres along the Columbia River, with a maximum home range size of 1038 acres. Nesting eagles concentrate activity in high productivity foraging areas within the home range and may actively use only 6% of the total area (McGarigal et al. 1991). In Missouri, food resources may not be as plentiful as in along the Columbia River and nesting home range sizes may be larger. However, even allowing for larger home range sizes near the Installation, it is unlikely nesting eagles forage on Fort Leonard Wood.

8.4 QUANTIFYING EXPOSURE - INTAKE VALUES

The third step in an exposure assessment is to quantify the exposure of receptors to stressors. We first determined the stressor concentration at the exposure point, then estimated the intake of the stressor at the same location. We estimated how often the exposure will occur, and related this information to the receptor (e.g. receptor location, seasonal presence).

We calculated an acute and chronic intake. Chronic intake values relate the concentration of the stressor to the expected exposure frequency, averaged over the receptors life. Acute intakes were determined by the stressor concentration expected in a single training event. Chronic intakes were calculated by using a modified version of the generic equation from EPA RAGS Volume I, Part A, Human Health Evaluation Manual (1989). The generic equation incorporates information about the frequency and duration of use of the stressor as well as information about the receptor. The equation was designed for use in assessing



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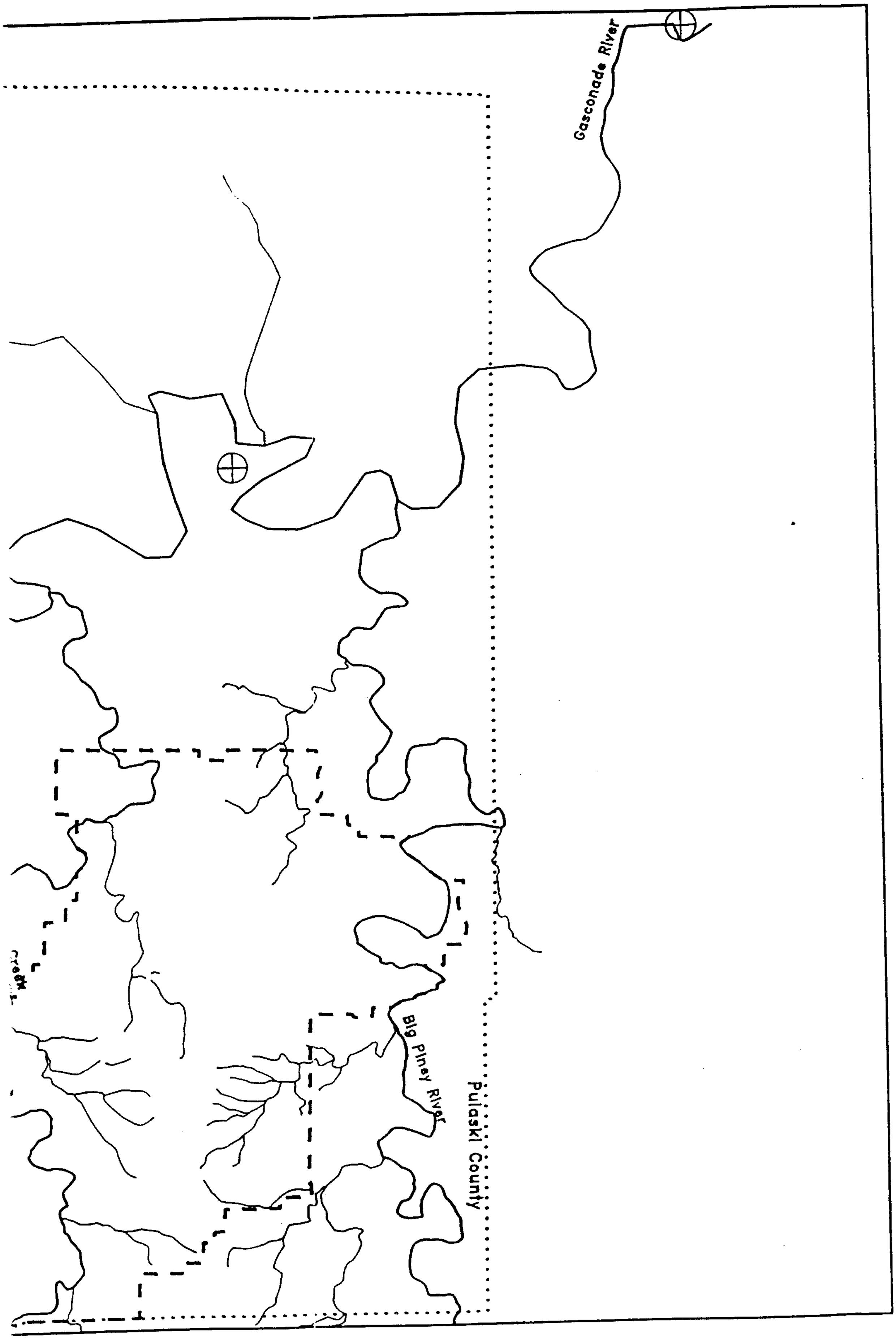

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FIGURE 30. L
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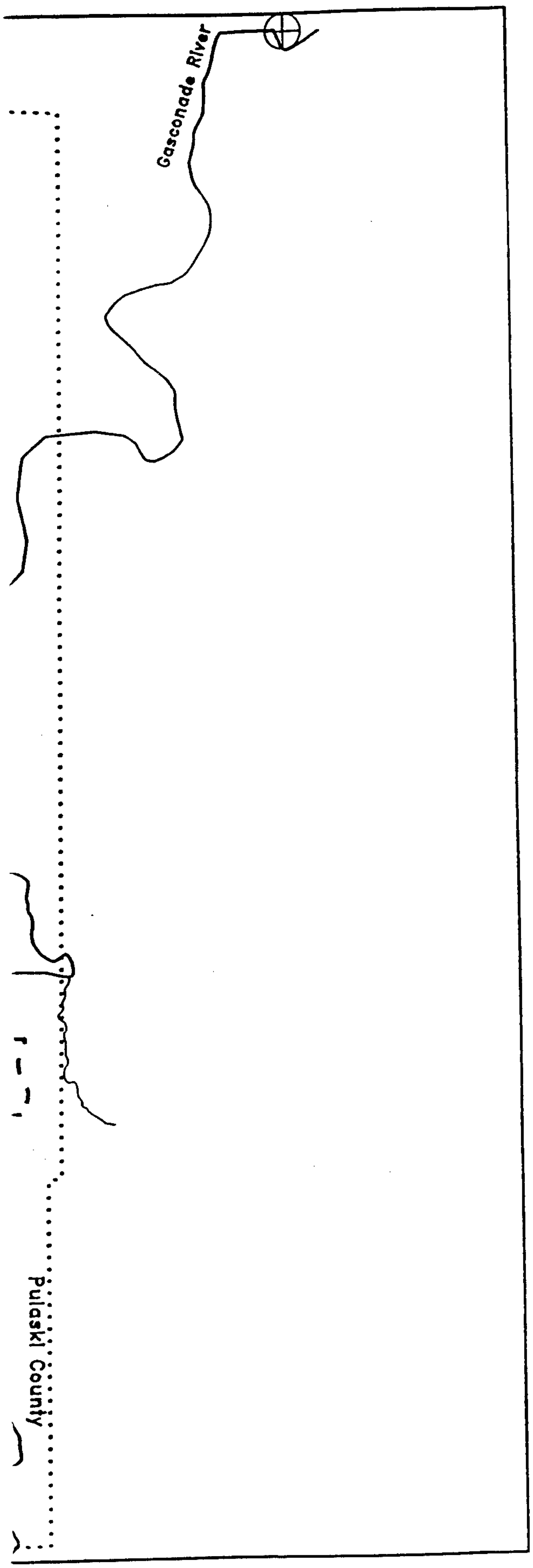


APPENDIX IV TO

BIOLOGICAL ASSESSMENT:

RELOCATION OF U.S. ARMY CHEMICAL SCHOOL AND MILITARY POLICE SCHOOL TO FORT LEONARD WOOD, MISSOURI

FIGURE 30. Location of bald eagle nests near Fort Leonard Wood, Missouri.

⊕ Bald Eagle Nest

Fort Leonard Wood Boundary

County Boundary

River / Stream

Kilometers

0 5 10

3D/ENVIRONMENTAL

exposure at Superfund sites. We modified the equation for our predictive ERA. The generic equation for calculating chemical intakes:

EPA (1989) generic intake equation

$$I = C\,(CR\,x\,\frac{EFD}{BW})\,\frac{1}{AT}$$

where:

I = Intake the amount of chemical at the exchange boundary (mg/kg body weight-day)
C = Chemical concentration; the average concentration contacted over the exposure period (e.g., mg/liter water)
CR = Contact rate; the amount of contaminated medium contacted per unit time or event (e.g., liters/day)
EFD = Exposure frequency and duration; describes how long and how often exposure occurs. Often calculated using two terms (EF x ED):
EF = Exposure frequency (days/years)
ED = Exposure duration (years)
BW = Body weight; the average weight over the exposure period (kg)
AT = Averaging time; period over which exposure is averaged (days)

We used the following equations to estimate inhalation, ingestion, and dermal intakes by receptor species (EPA 1989):

Inhalation Intake Equation (EPA 1989)

$$II = \frac{CA\,IR\,ET\,EF\,ED}{BW\,AT}$$

where:

II = Inhalation Intake (g/kg-day)
CA = Contaminant concentration in air (g/m^3)
IR = Intake rate (m^3/hour)
ET = Exposure time (hours/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (lifespan of receptor in days)

Ingestion Intake Equation (EPA 1989)

$$II = \frac{CF\,IR\,EF\,ED}{BW\,AT}$$

where:

II = Ingestion intake (g/kg-day)
CF = Quantity of contaminant deposited on food item (g/g)
IR = Intake rate (g/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (lifespan of receptor in days)

Dermal Absorption Intake Equation (EPA 1989)

$$DAI = \frac{CD\ SA\ ABS\ EF\ ED}{BW\ AT}$$

where:

DAI = Dermal Absorption Intake g/kg-day
CD = Quantity of contaminant deposited on receptor (g/m^2)
SA = Surface area of receptor (m^2)
ABS = Absorption factor (unitless), assumed equal to 1 (100% absorption)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (lifespan of receptor in days)

The intake rate for inhalation was modified to reflect the actual exposure duration for each event.

Input values for each receptor intake calculations and Pasquill category are given in Attachments C, D, E, and J. Fog oil, TPA, and titanium dioxide intake tables showing intake parameters used to calculate chronic daily intake are presented. Tables are organized by receptor and Pasquill category.

We evaluated inhalation and ingestion routes of exposure for each receptor in the screening risk assessment. We assumed 100% absorption of chemical stressors in the screening ERA and the detailed ERA. This may be conservative because certain chemicals taken into the body or placed on the dermis may not entirely enter the blood stream or pass through the skin. Without specific absorption coefficients for each receptor and stressor, we assessed the entire exposure concentration as the dose in intake calculations. In the

screening risk assessment, calculated intakes were compared to the selected toxicity values to determine if receptors would be exposed to unsafe concentrations of stressors. Only exposure concentrations of fog oil, TPA, and titanium dioxide are expected to exceed safe levels.

The screening risk assessment also involved estimating intakes of chemical stressors with a complete pathway to receptors. We determined there were 3 chemicals of potential concern: fog oil, terephthalic acid (TPA), and titanium dioxide. We calculated a chronic intake based on projected use. We estimated concentrations calculated for one field training exercise for the acute exposure concentration value. We multiplied the single-event concentration by the anticipated number of events per year to calculate the chronic exposure.

8.4.1 Stressor Concentrations

The concentration of each stressor was determined based on estimated quantities, expected release rate, and intended use. Predicted concentrations are based on the best available information, or modeled estimates. We consistently used "worst case" to define parameters related to stressor concentration. We used the best available information to estimate exposure scenarios and daily quantities.

Fog oil and TPA smokes are released into the atmosphere and disperse into the environment. Many exposure points are possible. Titanium dioxide is released in tiny particles that block infrared radiation. Dispersion of this stressor is relatively limited. To accurately determine stressor concentrations at exposure points, we adjusted exposure duration of fog oil, TPA, and titanium dioxide. We incorporated the concentration of the NOAEL or TRV in the cave air flow model and determined how long stressor concentrations would remain above safe levels in each hibernacula or maternity cave (NOAEL or TRV) (Tables 15 and 16).

We also assessed effects of chemical stressors to receptors that may occur widely on the installation (e.g. foraging Indiana bats, foraging gray bats, and bald eagles). Stressor concentrations at these exposure sites were measured from isopleths.

Threshold values describe the maximum exposure concentrations that do not affect receptors. We calculated threshold values for fog oil, TPA grenades, TPA smoke pots, and titanium dioxide grenades. Threshold values were determined for each receptor and exposure pathway (Attachment I).

8.4.1.1 Fog Oil

Static fog oil training will be conducted only at Range 30F (Figure 5). There will be 20 stationary generators running at a release rate of 0.66 gallons per minute. The expected daily maximum consumption of fog oil (static or mobile) is 1200 gallons. The yearly static training requirement is 8500 gallons. Mobile smoke training will occur at 4 areas (Section 4.1.7). A maximum of 12 generators will be used simultaneously in mobile smoke training. Our analysis was based on a percentage of 76,000 gallons of fog oil being released on mobile smoke training areas: Ballard Hollow (20%), Cannon Range (Mush Paddle Hollow) (25%), Musgrave Hollow (40%), and Bailey McCann Hollow (30%). We assessed effects to foraging/roosting Indiana bats, foraging gray bats, and traveling bald eagles assuming 42,200 gallons of fog oil will be deployed at any of the mobile smoke training areas.

Static and mobile training may occur on the same day (not at the same time), but for this analysis, we assumed they would not. This approach allows evaluation of a scenario where the maximum daily fog oil quantity (1200 gallons) would be used by either mobile or static training. The smoke from 32 generators (20 static plus 12 mobile) will not operate simultaneously at the same location. We considered 20 generators consuming 1200 gallons of fog oil a day.

We used the TREMS1 air dispersion model to calculate dispersion of fog oil. We performed a comparative analysis to determine which of 3 air dispersion models would give the highest concentrations at the greatest distance under identical meteorological conditions. A discussion paper has been prepared which explains the rationale used to select the TREMS1 model. TREMS1 is described in detail in the Ongoing Mission BA (3D/Environmental 1996). A deposition velocity was added to the model to create deposition isopleths that calculate the amount of fog oil to be deposited downwind of the generators.

We modeled dispersion and deposition of stressors for Pasquill atmospheric stability categories B, C, D, and E. We varied sample heights and wind speeds on concentration and deposition plots for static and mobile training. Figures 14, 15, 16, and 17 are concentration isopleths for static smoke (20 generators). Figures 18, 19, 20, and 21 are concentration isopleths for mobile smoke training (12 generators). Figure 22 describes deposition from fog oil static training under Pasquill category E. Figure 23 depicts deposition from fog oil mobile

smoke training under Pasquill E. Additional deposition isopleths are presented in Attachment B.

After concentrations of stressors reaching Indiana bat hibernacula and gray bat maternity caves were determined, we calculated the time over which stressor concentrations would reach equilibrium in the caves. We then calculated the time during which stressor concentrations would exceed safe concentrations (above a TRV). We incorporated the amount of time a stressor would remain above safe concentrations into intake calculations. We adjusted the inhalation rate of bats in caves to reflect the amount of time predicted fog oil concentration remains above safe levels.

8.4.1.2 Terephthalic Acid

We assessed the effect of the maximum number of TPA grenades and smoke pots being released one at a time to determine the concentration of TPA at expected exposure points. Both grenades and smoke pots have short burn times (2.5 minutes). We used TREMS1 to estimate dispersion of TPA. We modeled the dispersion under Pasquill categories B, C, D, and E for both TPA grenades and smoke pots. With TREMS 1, we modeled the dispersion of TPA (fog oil, and titanium dioxide) downwind of sources based upon 3 m/second wind speed and 3 m sample height. Pasquill B showed the greatest dispersion of both forms of TPA, therefore we only present and describe effects for Pasquill B (Figures 31 and 32). All modeled dispersion isopleths for TPA (grenades and smoke pots) were very similar for each Pasquill category. TPA does not disperse very far from the source under any Pasquill category.

TPA grenades will be used at 22 locations and TPA smoke pots will be used at 5 locations (Figure 32) and 4 mobile fog oil smoke training areas (Figure 5) on the installation. We measured TPA concentrations at each of the 31 locations and used these as exposure concentrations. Distances were measured from each of the 31 TPA smoke training areas to locations particularly sensitive to exposure (e.g. Indiana bat hibernacula). Exposure concentrations were based on distances from smoke training areas to exposure points. We determined concentrations at the described distance from concentration isopleths (Figures 31 and 32). Exposure concentrations for receptors that could occur widely on the Installation (e.g.

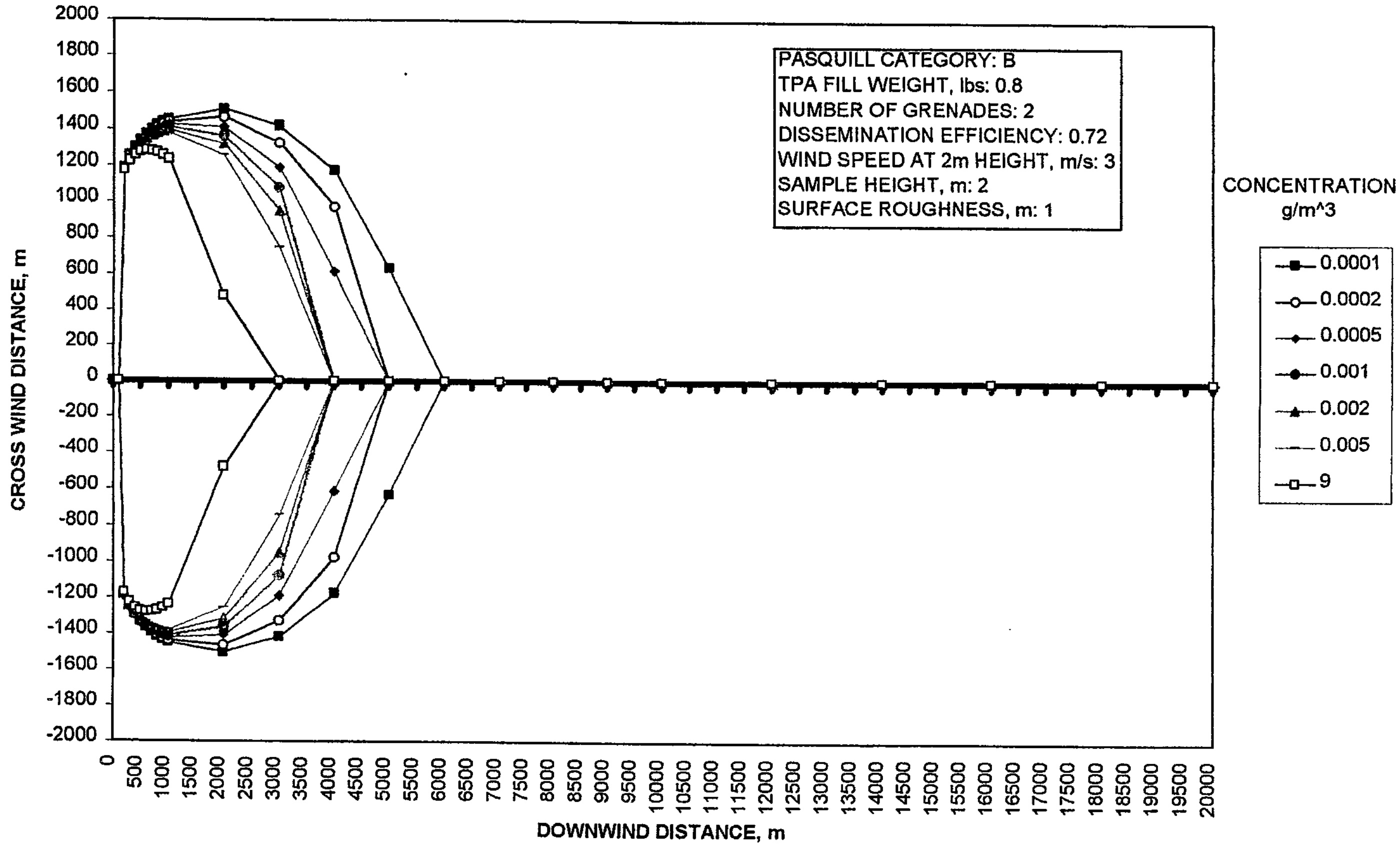


FIGURE 31. Concentration of terephthalic acid from smoke grenades (Pasquill B) at varying distances from smoke grenade training locations.

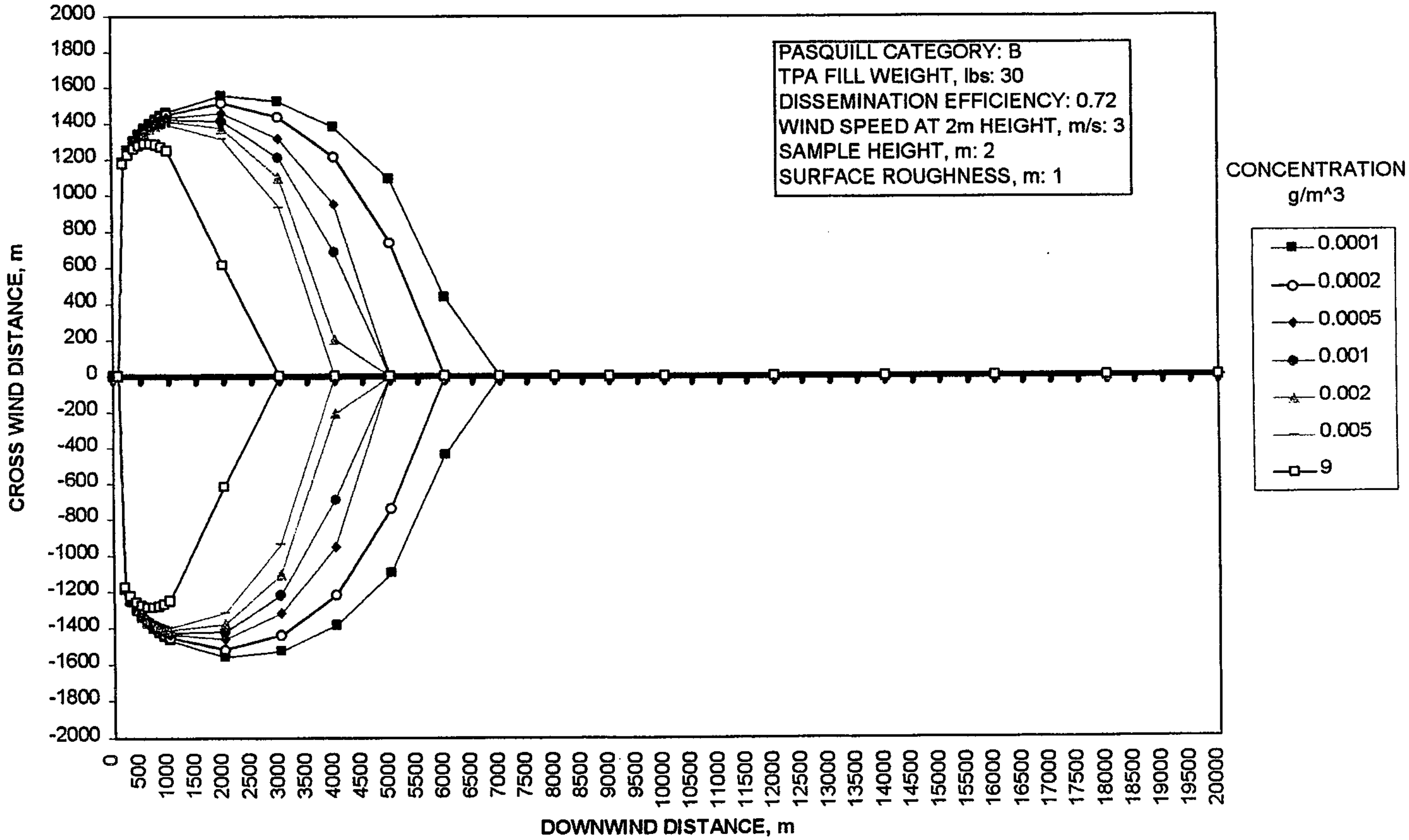


FIGURE 32. Concentration of terephthalic acid from smoke pots (Pasquill B) at varying distances from smoke pot training locations.

foraging Indiana bats) were measured at the source at each of the TPA smoke training areas. We assumed receptors could forage anywhere in any of the 31 TPA smoke training locations.

We used the following assumptions when calculating the exposure of receptors to TPA smoke grenades (Emily Brown, Fort Leonard Wood, pers. comm.):

- 131 training days per year
- 3136 TPA grenades maximum per year
- 2242 grenades from 1 November through 15 March (93 training days)
- 141 grenades maximum used daily at any combination of the 22 training locations
- 24 grenades maximum per day from any one training location
- 2.5 minute burn time

We used the following assumptions in our calculations of exposure of receptors to TPA smoke pots (Emily Brown, Fort Leonard Wood, pers. comm.):

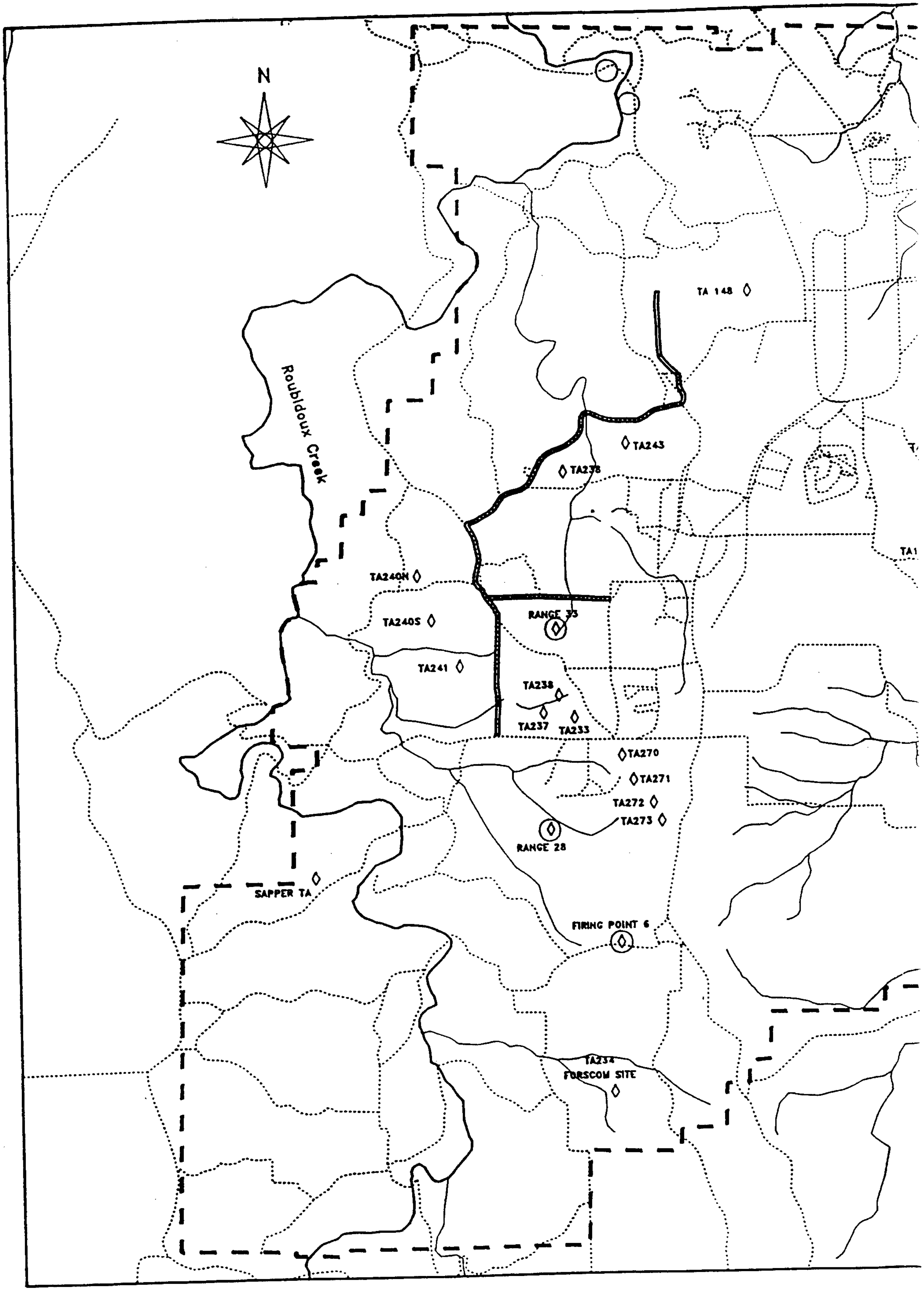
- 16 training days per year
- 950 TPA smoke pots maximum per year
- 59 smoke pots maximum used daily from any of the 22 training locations
- 2.5 minute burn time

We evaluated inhalation, but not ingestion or dermal absorption. Because burn times are short for grenades and smoke pots, and components of the smoke are gases, complete ingestion and dermal absorption pathways do not exist.

8.4.1.3 Titanium Dioxide

Titanium dioxide will be released from M82 grenades at Fort Leonard Wood at the 22 smoke grenade training locations (Figure 33). We estimated concentrations of titanium dioxide in the atmosphere after a release (Figure 34). We modeled the dispersion of titanium dioxide under Pasquill categories B, C, D, and E. For the conditions we assessed, Pasquill category E created the greatest dispersion of titanium dioxide. The dispersion of titanium dioxide does not disperse very far from the source under any Pasquill category.

We evaluated effects of titanium dioxide only for inhalation. Based on the relatively short burn time (less than 2.5 minutes) and the type of material that is released, complete ingestion and dermal absorption exposure routes do not exist.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Roubidoux Creek
TA 148
TA243
TA238
TA240N
TA240S
RANGE 33
TA241
TA238
TA237
TA233
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RANGE 28
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FIRING POINT 6
TA234
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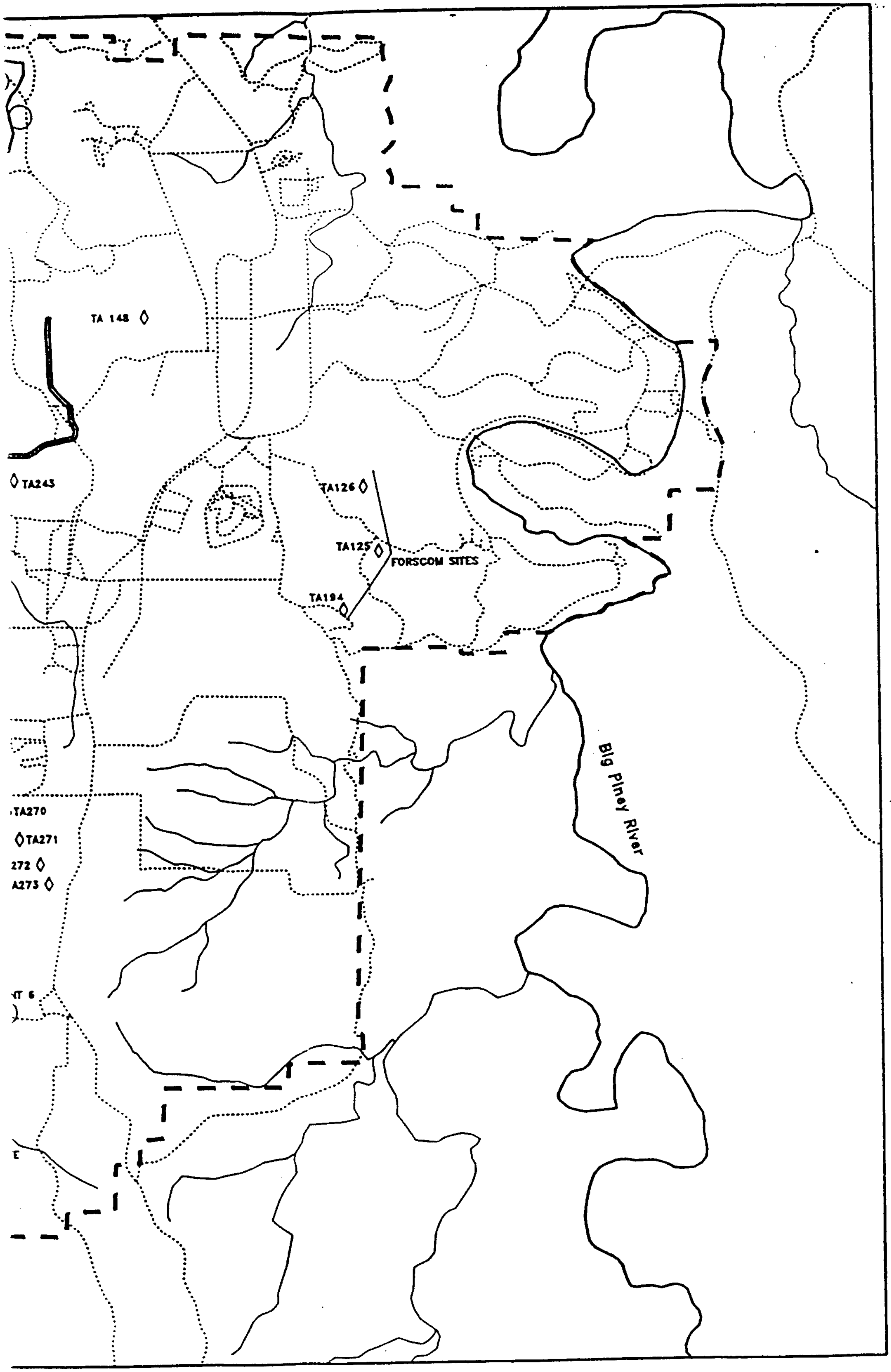

APPEND

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FIGURE 33. Sm
smoke pot training
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Smoke Pot

Smoke Gren

Smoke Gren

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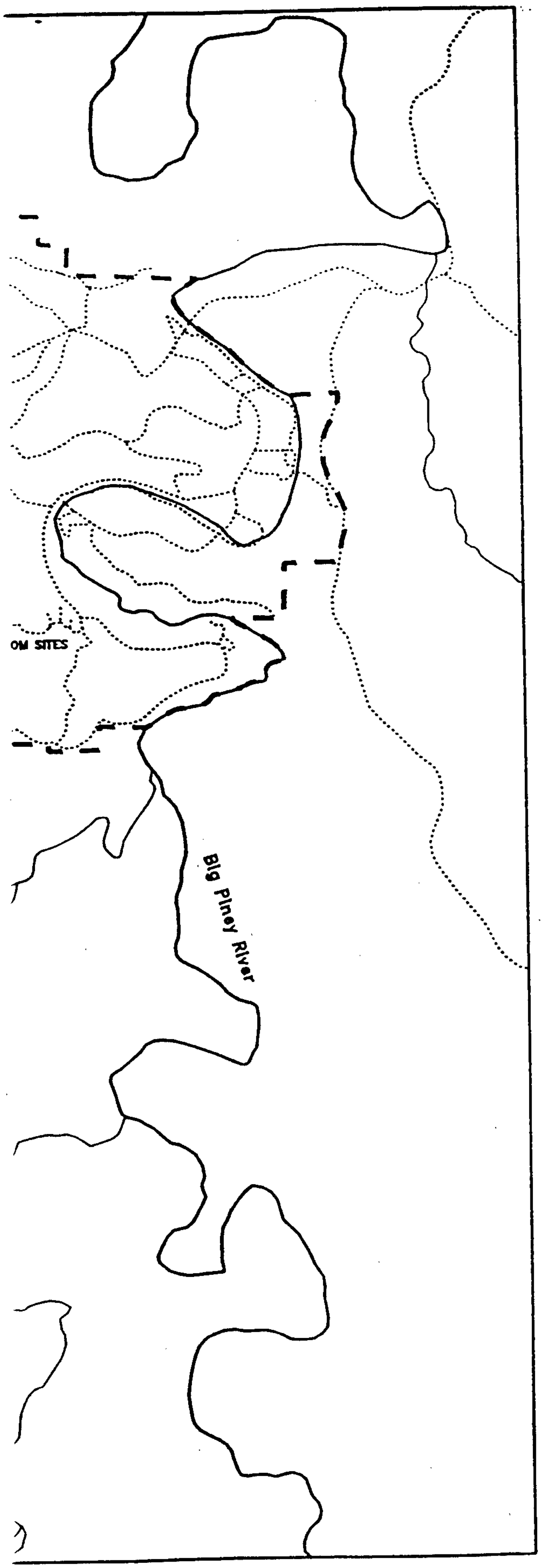

APPENDIX IV TO
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RELOCATION OF U.S. ARMY CHEMICAL SCHOOL AND MILITARY POLICE SCHOOL TO FORT LEONARD WOOD, MISSOURI

FIGURE 33. Smoke grenade and smoke pot training locations for Fort Leonard Wood, Missouri.

Smoke Pot Use Area

Smoke Grenade Use Area

Smoke Grenade Training Road

Fort Leonard Wood Boundary

Road

River / Stream

Kilometers

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3D/ENVIRONMENTAL

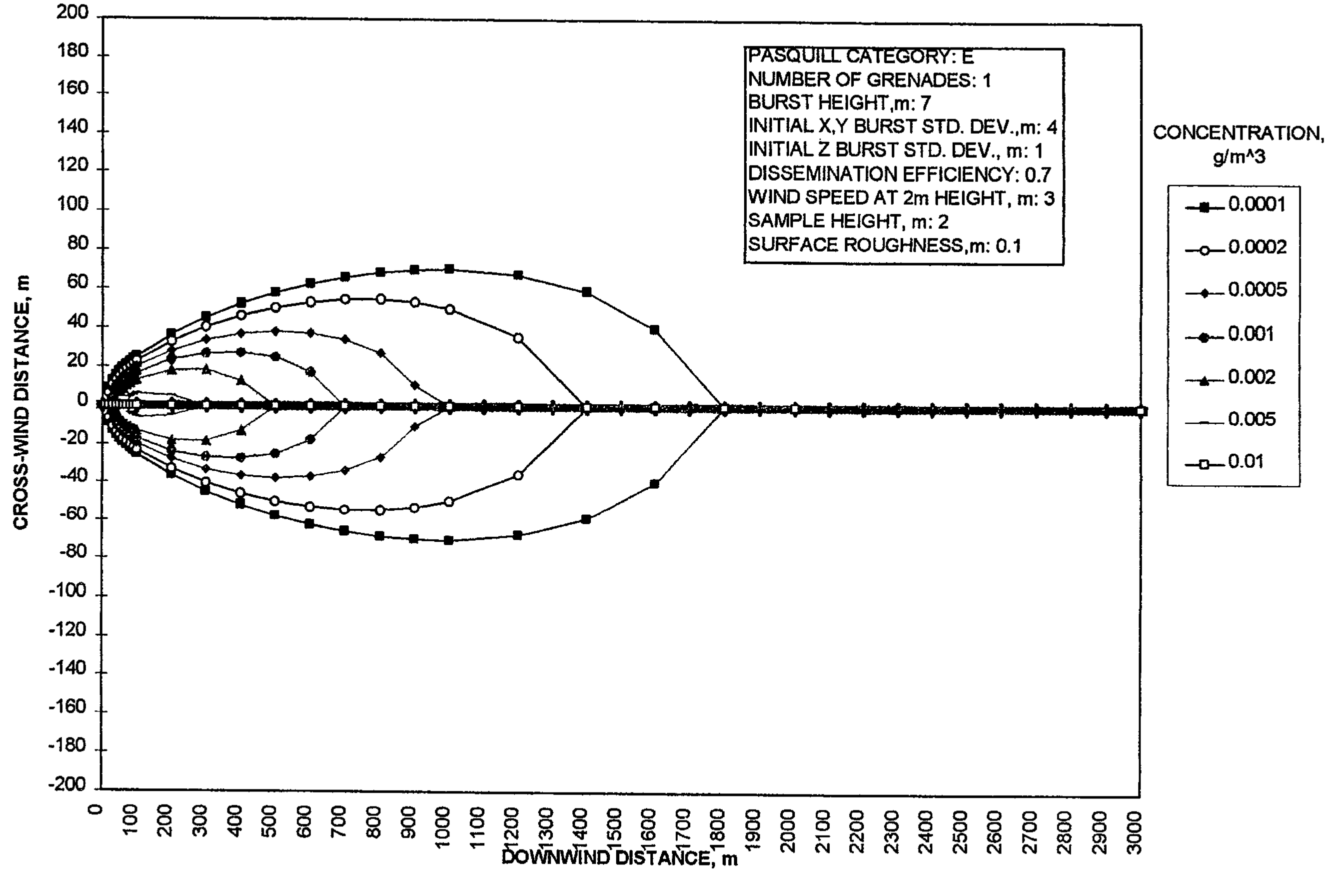


FIGURE 34. Concentration of titanium dioxide from grenades (Pasquill E) at varying distances from grenade training locations.

We estimated titanium dioxide intakes using the following assumptions (Emily Brown, Fort Leonard Wood, pers. comm.):

- 48 grenades per year
- 24 grenades per day from any training location
- 2 training days per year
- 2.5 minute burn time

8.4.2 Receptor Parameters for Intake Calculations

We incorporated specific physiological and life history data for each receptor in calculations of chronic intake. Calculations of inhalation involved only the inhalation rates of receptors. Calculations of dermal absorption for fog oil required assessment of receptor surface area. Analysis of intake via ingestion for fog oil were based upon surface area of prey species. Complete dermal absorption and ingestion pathways do not exist for TPA and titanium dioxide.

In calculating ingestion of fog oil, we assumed prey consumed by receptors were coated with fog oil. We determined the amount of fog oil that would cover food within areas defined by each deposition isopleth. We selected prey and food items representing average prey or food consumed by each receptor species. Assumptions regarding diets and calculations of prey surface areas for each receptor species are described in Section XI.

We addressed certain stages of each receptors life cycle that may be considered more sensitive than the adult stage. Specific receptor values used in these sensitive life cycle stages intake and risk calculations are presented in the following sections for each receptor.

8.4.2.1 Indiana Bats

Intake calculations for Indiana bats were based upon information provided in Table 19.

We adjusted the inhalation rate in our intake equation for hibernating and foraging Indiana bats to reflect the amount of time stressors will remain at the exposure concentrations. The duration of static fog oil training is 1.5 hours, mobile training will last 2.5 hours. We assumed the duration of TPA and titanium dioxide training events will be 2.5 minutes.

TABLE 19. Characteristics of Indiana bats used in intake equations.

Factor	Mean
Lifespan	7 years
Duration of hibernation	7 months
Body weight while hibernating	6 grams
Duration of foraging period	6 months
Inhalation rate	3.4E-4 m^3/day
Ingestion rate	2.5 grams per day
Surface area of prey	3.3E-5 m^2 per day
Surface area of adult Indiana bat	.022 m^2
Body weight while foraging	8 grams
Nursing pup weight (18 days old)	6 grams
Supplemental nursing pup (27 days old)	7 grams

Post-lactating female Indiana bats have been captured on Fort Leonard Wood. One or more nursery colonies may exist on, or near the installation. Because nursing Indiana bats may be more sensitive to chemical stressors (based on their reduced body weight and high metabolic rate), we assessed effects to nursing pups and supplemental nursing pups (pups that forage and nurse). Based upon information available for a closely related species, the little brown bat, Indiana bat pups likely nurse exclusively until they are about 18 days old (Kurta et al. 1989). Supplemental nursing occurs from about 18 days until the pups are approximately 27 days old. Exposure points for nursing and supplemental nursing pups were the same as adult foraging and roosting locations.

8.4.2.2 Gray Bats

Intake calculations for gray bats were based upon information provided in Table 20.

We adjusted the inhalation rate in our intake equation for gray bats in maternity colonies and foraging gray bats to reflect the amount of time stressors will remain at the exposure concentration.

We assessed effects to nursing gray bat pups because they may be more sensitive to chemical stressors (based on their reduced body weight and high metabolic rate). We assessed effects to nursing pups and supplemental nursing pups (pups that forage and nurse). Gray bat pups nurse exclusively until they are about 20 days old. Supplemental

TABLE 20. Characteristics of gray bats used in intake equations.

Factor	Mean
Lifespan	10 years
Duration of summer foraging period	6 months
Duration of summer roosting period	8 months
Body weight adult	10.5 grams
Inhalation rate	3.4E-4 m^3/day
Ingestion rate	2.5 grams / day
Surface area of prey	3.3E-5 m^2 / day
Surface area of adult gray bat	.026 m^2
Body weight while foraging	8 grams
Nursing pup weight (20 days old)	5.4 grams
Supplemental nursing pup (45 days old)	7.1 grams

nursing occurs from about 20 days until the pups are 40 to 50 days old (LaVal and LaVal 1980). Exposure points for nursing and supplemental nursing pups were the same as adult foraging and roosting locations.

8.4.2.3 Bald Eagles

Intake calculations for bald eagle were based upon information provided in Table 21. We adjusted the inhalation rate in our intake equation for foraging and nesting bald eagles to reflect the amount of time stressors will remain at the exposure concentration.

TABLE 21. Characteristics of bald eagles used in intake equations.

Factor	**Mean**
Lifespan	35 years
Duration of summer period	5 months
Duration of winter period	7 months
Body weight of adult and juvenile	4.5 kilograms
Surface area of adult and juvenile	0.275 m^2
Ingestion rate of adult and juvenile	0.2925 kg/day
Inhalation rate of adult and juvenile	1.31 m^3/day
Inhalation rate of hatchling	0.24 m^3/day
Body weight of egg (35 days old)	120 grams
Body weight of hatchling (10 days old)	500 grams
Surface area of egg	108.31 cm^2

We assessed effects to three bald eagle life stages: eggs, hatchlings, and juveniles. We used life history information for a 10-day old neonate to assess effects to hatchlings. Juvenile eagles are physiologically and morphologically similar to adults, but are sexually immature. We evaluated effects of fog oil to bald eagle eggs by the dermal pathway, effects to bald eagle hatchlings by the inhalation pathway, and bald eagle juveniles by ingestion, inhalation, and dermal absorption pathways.

Section 9
Risk Characterization and Discussion

Section IX:

Risk Characterization and Discussion

9.1 INTRODUCTION

Characterizing risk incurred by receptors as a result of their association with stressors involves integrating toxicological information and values developed in the toxicity assessment with intake values determined in the exposure assessment. This integration approach is recognized and acceptable for human health risk assessments and is applied here to estimate effects to non-human receptors (EPA 1995). Risks are characterized to identify stressors that will be toxic to adult and other life cycle stages of receptors.

Acute and chronic unsafe stressor concentrations are established in the toxicity assessment. We developed TRVs (toxicity reference values) for each receptor and route of exposure. TRVs are based on a NOAEL or LOAEL, or an effects level, such as LD_{50}. Acute toxicity values from tests where stressors were administered in single doses, were selected for the acute toxicity values in this study. Chronic toxicity values used in this study were selected from studies where the stressor was administered in multiple doses over an extended period of time. TRVs were developed for each receptor by applying Uncertainty Factors (UFs) to toxicity values generated for other species. The application of UFs accounts for sensitive life cycle stages of the Indiana bat, gray bat, and bald eagle. Because TRVs are reduced by several UFs, the reduction should account for different sensitivities of test species and receptors, including sensitive life cycle stages.

Exposure concentrations were determined by modeling dispersion and deposition of fog oil, TPA, and titanium dioxide in various atmospheric stabilities (Pasquill categories). We used exposure concentrations to estimate the amount of fog oil, TPA, and titanium dioxide receptors would intake. Adult receptor intakes were calculated for inhalation, ingestion, and dermal absorption pathways for fog oil, and for the inhalation pathway for TPA and titanium dioxide. Intake values calculated for sensitive life cycle stages were based on the Pasquill categories where the greatest downwind dispersion was estimated for each stressor (Pasquill category E for fog oil, Pasquill category B for TPA, and Pasquill category E for titanium dioxide).

We evaluated effects of fog oil, TPA, and titanium dioxide inhalation by Indiana bats and gray bats adults, nursing pups, and supplemental nursing pups. We concluded pups would not be affected by ingesting contaminated prey based upon our analysis of the same topic for adult bats. We did not examine the effect of bat pups receiving stressor doses on their skin because there we found no effects for adults, which have a larger surface area for dermal absorption. We assessed effects to four bald eagle life stages: eggs, hatchlings, juveniles, and adults. We evaluated effects from fog oil to bald eagle eggs via dermal exposure, bald eagle hatchlings via inhalation, and juveniles and adults by ingestion, inhalation, and dermal absorption. TPA and titanium dioxide have incomplete pathways to Indiana bats, gray bats, and bald eagles through dermal absorption and ingestion.

We adjusted EPA (1989) intake equations to reflect receptors being chronically exposed to fog oil, TPA, and titanium dioxide at Fort Leonard Wood. Acute intake values were based on concentration and deposition isopleths. We did not use chronic exposure intake equations to estimate acute effects. We assessed acute effects based upon the highest one-time contaminant exposure predicted. Attachments C, D, E, and J present intake tables for receptors, including sensitive life stages. We calculated the total amount of stressors that would reach receptors skin, that would occur on receptor's food, and that receptors would inhale. We used these amounts as estimates for exposure concentrations.

We developed an acute and chronic Hazard Quotient (HQ) for each receptor and each pathway based on modeled fog oil dispersion in Pasquill categories B, C, D, and E, modeled TPA dispersion under Pasquill category B, and titanium dioxide under Pasquill category E. Acute and chronic HQs were determined as follows:

$$HQ_{acute} = \text{Exposure Concentration} \div TRV_{acute}$$

$$HQ_{chronic} = \text{Chronic Daily Intake} \div TRV_{chronic}$$

When the hazard quotient is used to characterize non-carcinogenic effects, it provides a tool to realistically compare exposure concentrations to unsafe (toxic) concentrations. Hazard quotients are simple tools that provide point estimates relating presumed exposure concentrations to known or extrapolated effects levels of toxicants (Wentsel et al. 1994).

Risk characterization tables are presented in Attachments F, G, and H for adults of each species. Appendix J presents risk characterization tables for sensitive life stages. Each table indicates the distance from the source the concentration or deposition isopleth extends, chronic daily intakes, acute exposure concentrations, acute and chronic TRVs, uncertainty adjustments, acute and chronic critical studies, acute and chronic critical effects, acute and chronic HQs, and an effect determination. Tables are organized by species and Pasquill category for the adults.

Toxicological studies that generated toxicity values utilized in this ecological risk assessment also describe the effects of experimental exposures to test subjects. These effects are typically referred to as "critical effects." Because no, or limited, data is available describing effects likely to be manifested in Indiana bats, gray bats, and bald eagles, we assume effects will be similar to critical effects reported in the literature. Specifically:

- Inhalation of Fog Oil

  acute effect: *oil pneumonia*
  chronic effects: *minor lesions of the heart, liver, and lungs*

- Ingestion of Fog Oil

  acute effects: *weight loss; lesions of the liver, spleen, and kidney*
  chronic effect: *gastrointestinal irritation*

- Dermal Absorption of Fog Oil

  acute effect: *slight to moderate skin irritation*
  chronic effects: *well defined erythema and edema*

- Inhalation of Terephthalic Acid

  acute effect: *necrosis and inflammation of the nasal cavity*
  chronic effect: *edema of lungs and emphysema*

- Inhalation of Titanium Dioxide

  acute effect: *respiratory irritation*
  chronic effect: *respiratory irritation*

Acute and chronic effects (HQs > 1) are discussed in the following sections. Effects are determined and a brief discussion is presented. We discuss effects based on conditions and assumptions defined in our assessment. If all conditions are not met and a receptor is exposed to the stressor, the effect may or may not occur as described. Acute effects result from single exposure events. Chronic effects result from exposures averaged over the receptor's life span. The term "repeated" is used to define chronic exposures.

We describe direct effects in this section. Direct effects result when the receptor has immediate or intimate contact with the stressor. Indirect effects are caused when stressors reach receptors through a media or transport mechanism. For example, indirect effects may include transfer of contaminant from a lactating bat to a nursing pup through the milk. Indirect effects can cause behavioral changes that affect the individual's ability to survive, avoid predators, mate, reproduce, or obtain food. Indirect effects may occur when prey species populations are modified.

Indirect effects are not expected to result to Indiana bats, gray bats, or bald eagles on Fort Leonard Wood as a result of the BRAC Action. There is little information about the toxicological effects or ecological effects from of stressors evaluated in this ERA. No information exists to predict changes in receptor populations based upon changes in prey populations. Measurement endpoints to characterize indirect effects, including indirect effects to receptor *populations,* are not available. Inferences can be made by examining past studies or studies on similar receptors and stressors.

Data collected at Fort McClellan, Alabama by 3D/I did not indicate major differences in insect populations between fog oil exposure sites and a reference site. The study did not reveal statistically significant differences in concentrations of fog oil hydrocarbons in insect, vegetation, fish, or bat tissues from exposure sites and the reference site. Soil, surface water,

air, and sediment samples did not show fog oil accumulated in the environment. Based on this information, fog oil is not expected to affect prey populations because it does not remain in the environment, and does not bioaccumulate in biota.

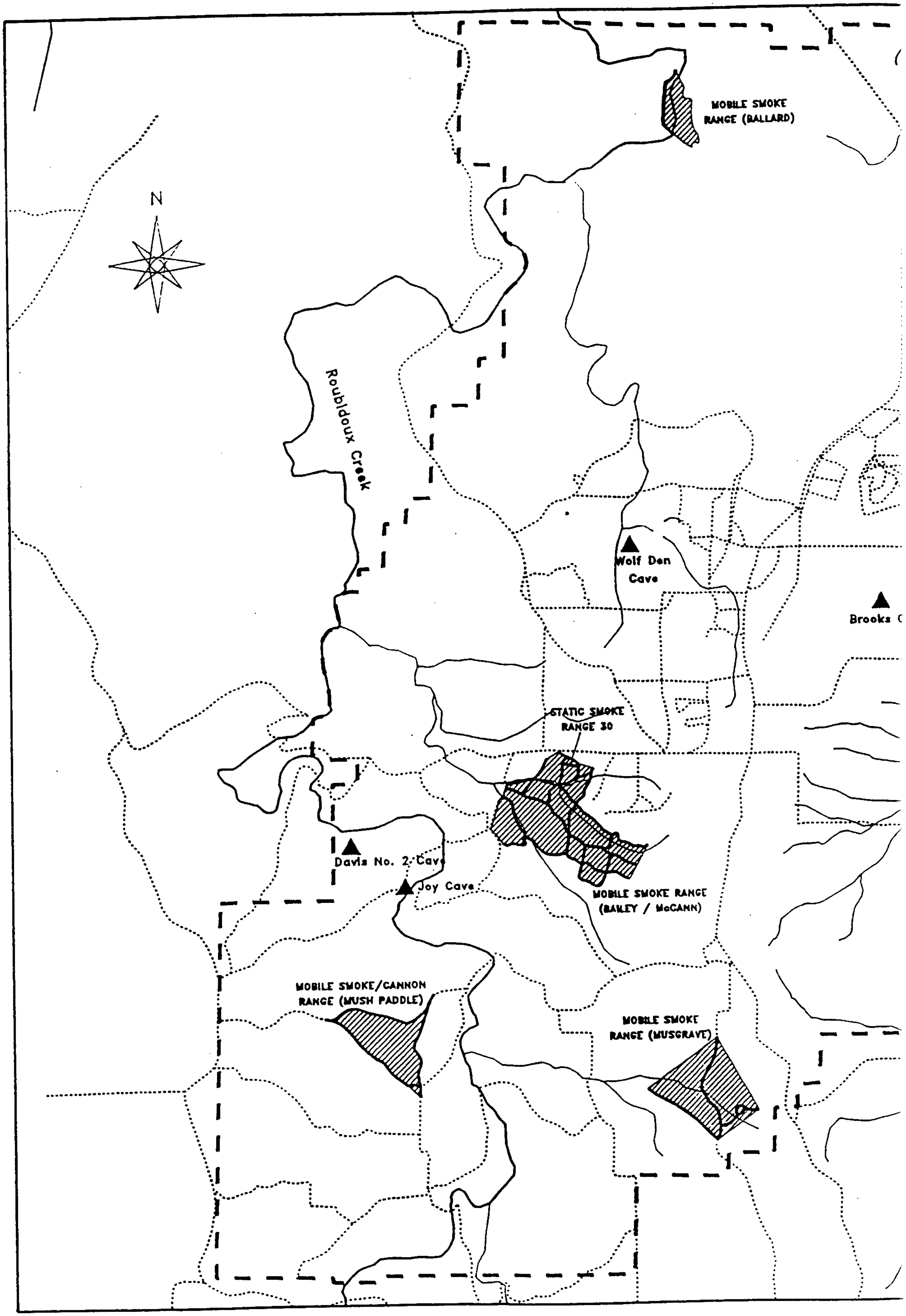
While fog oil is not expected to indirectly affect Indiana bats, gray bats, or bald eagles, there are several other chemical stressors with potential to cause indirect effects. Certain of these chemical stressors will be used only within enclosures (buildings) or released in such a manner that they will not reach receptors (Table 12). These chemical stressors will not cause direct or indirect effects. Other chemical stressors will be used only in minute quantities (relative to toxicity) or are non-toxic (see Section 8.2.2). The expendable training materials (Attachment A), terephthalic acid grenades, terephthalic acid smoke pots, and titanium dioxide may potentially cause indirect effects. No data exist to predict or evaluate these potential indirect effects with any reasonable certainty.

To detect changes that may indirectly effect receptors, Fort Leonard Wood will implement a biomonitoring program. The program will monitor water quality, media toxicity, certain insect populations, selected fish populations, vegetation, and the populations of Indiana bats, gray bats, and bald eagles on the installation. The program will detect changes in parameters listed above between exposure sites and reference sites. While natural variability in monitored parameters will preclude certain strict statistical evaluations of differences between exposure and reference sites, Fort Leonard Wood will employ a weight of evidence approach to indicate some change.

9.2 RISK OF EXPOSURE TO FOG OIL FROM STATIC AND MOBILE TRAINING

9.2.1 Indiana Bats

Indiana bats at Fort Leonard Wood will be affected by static and mobile fog oil training. We assessed effects from exposure to static and mobile fog oil training to foraging (installation-wide), roosting (installation-wide) and hibernating (hibernacula) Indiana bats (Figure 35). We assumed exposure to Indiana bat nursing-pups and supplemental nursing pups could occur at the same locations as foraging and roosting adults. Distances from Indiana bat hibernacula to fog oil smoke training locations are provided in Table 22.



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RANGE (BALLARD)
Roubidoux Creek
Wolf Den
Cave
Brooks C
STATIC SMOKE
RANGE 30
MOBILE SMOKE RANGE
(BAILEY / McCANN)
Davis No. 2 Cave
Joy Cave
MOBILE SMOKE/CANNON
RANGE (MUSH PADDLE)
MOBILE SMOKE
RANGE (MUSGRAVE)

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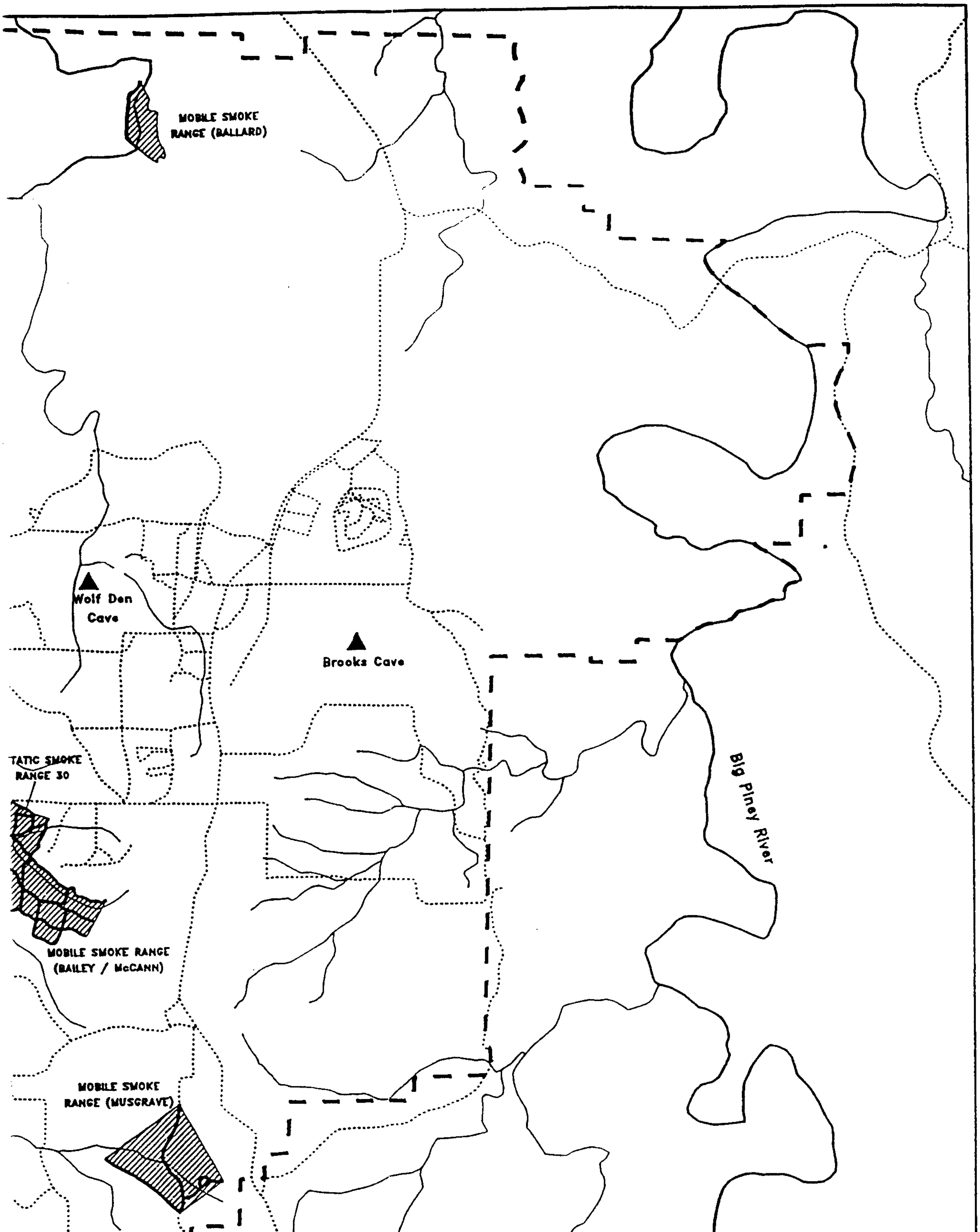

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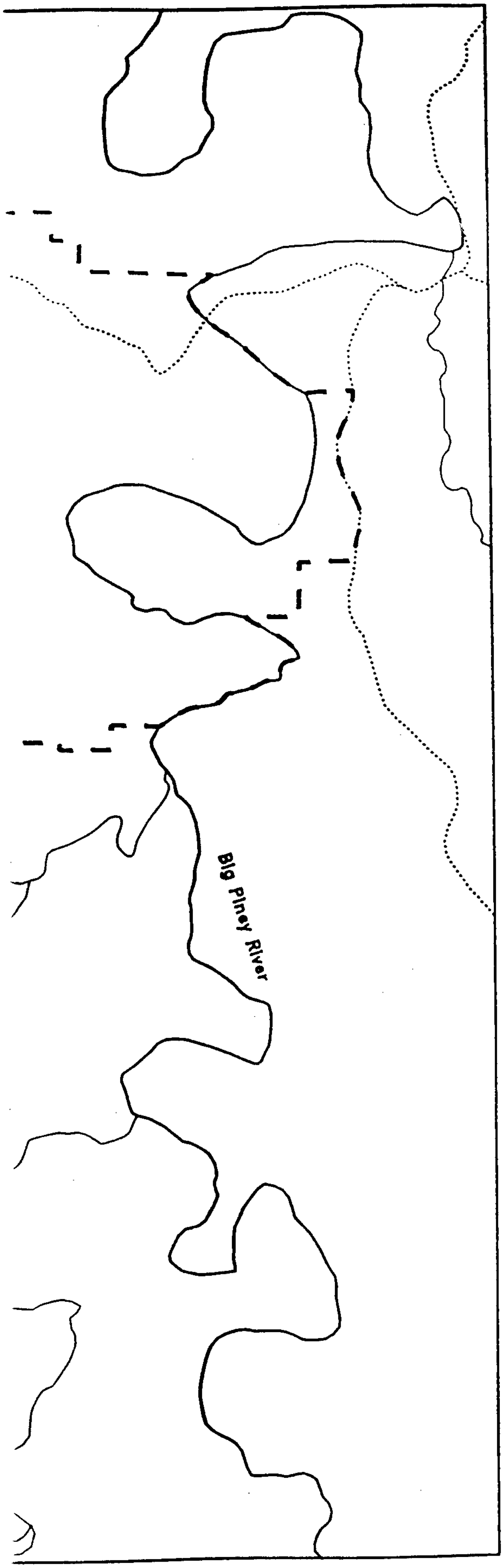

APPENDIX IV TO

BIOLOGICAL ASSESSMENT:

RELOCATION OF U.S. ARMY CHEMICAL SCHOOL AND MILITARY POLICE SCHOOL TO FORT LEONARD WOOD, MISSOURI

FIGURE 35. **Indiana bat hibernacula and proposed fog oil smoke training locations at Fort Leonard Wood, Missouri.**

▲ Indiana Bat Cave

Offroad Mobile Smoke Training Range

Mobile Smoke Deployment Road

Fort Leonard Wood Boundary

Road

River / Stream

Kilometers

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TABLE 22. Distances from static and mobile smoke training areas to Indiana bat hibernacula.

Cave	Fog Oil Smoke Training Location	Distance (m)
Brooks	Static Smoke TA at 30F	6037
Brooks	Mobile Smoke TA at Musgrave Hollow	8031
Brooks	Mobile Smoke TA at Cannon Range (Mush Paddle Hollow)	10,335
Brooks	Mobile Smoke TA at Bailey/McCann Hollow	5803
Brooks	Mobile Smoke TA at Ballard Hollow	8449
Davis No. 2	Static Smoke TA at 30F	3927
Davis No. 2	Mobile Smoke TA at Musgrave Hollow	6624
Davis No. 2	Mobile Smoke TA at Cannon Range (Mush Paddle Hollow)	2889
Davis No. 2	Mobile Smoke TA at Bailey/McCann Hollow	2423
Davis No. 2	Mobile Smoke TA at Ballard Hollow	13,352
Wolf Den	Static Smoke TA at 30F	3878
Wolf Den	Mobile Smoke TA at Musgrave Hollow	8609
Wolf Den	Mobile Smoke TA at Cannon Range (Mush Paddle Hollow)	8432
Wolf Den	Mobile Smoke TA at Bailey/McCann Hollow	3861
Wolf Den	Mobile Smoke TA at Ballard Hollow	6859
Great Spirit	Static Smoke TA at 30F	9524
Great Spirit	Mobile Smoke TA at Musgrave Hollow	14,973
Great Spirit	Mobile Smoke TA at Cannon Range (Mush Paddle Hollow)	12,357
Great Spirit	Mobile Smoke TA at Bailey/McCann Hollow	9307
Great Spirit	Mobile Smoke TA at Ballard Hollow	7430
Joy	Static Smoke TA at 30F	3682
Joy	Mobile Smoke TA at Musgrave Hollow	5499
Joy	Mobile Smoke TA at Cannon Range (Mush Paddle Hollow)	1803
Joy	Mobile Smoke TA at Bailey/McCann Hollow	2045
Joy	Mobile Smoke TA at Ballard Hollow	13,821

9.2.1.1 Inhalation

Static Training

Indiana bats will inhale unsafe doses of fog oil from static fog oil training while foraging, roosting, and hibernating.

- No acute inhalation effects to foraging, roosting or hibernating Indiana bats are expected.

- No acute or chronic inhalation effects to nursing or supplemental nursing Indiana bat pups are expected.

- Indiana bats repeatedly foraging or roosting within 4000 m of static fog oil smoke training will be exposed to unsafe concentrations of fog oil, and exhibit chronic inhalation effects.

- Indiana bats hibernating in Davis No. 2 Cave will inhale concentrations of fog oil released from static fog oil training areas that will result in chronic inhalation effects.

Mobile Training

Indiana bats will inhale unsafe doses of fog oil from mobile fog oil training while foraging, roosting, and hibernating.

- No acute inhalation effects to foraging, roosting or hibernating Indiana bats are expected.

- No acute or chronic inhalation effects to nursing or supplemental nursing Indiana bat pups are expected.

- Indiana bats repeatedly foraging or roosting within 7000 m of active mobile fog oil smoke training locations, will be exposed to unsafe concentrations of fog oil, and exhibit chronic inhalation effects.

- Indiana bats hibernating in Davis No. 2, Wolf Den, and Joy caves will inhale concentrations of fog oil released from Bailey/McCann mobile fog oil training area that will result in chronic inhalation effects.

- Indiana bats hibernating in Davis No. 2 and Joy caves will inhale unsafe concentrations of fog oil from Cannon Range (Mush Paddle Hollow) mobile smoke training area that will result in chronic inhalation effects.

9.2.1.2 Ingestion

Static Training

No acute or chronic ingestion effects were determined for foraging or roosting Indiana bat adults or pups from static fog oil training. Although incidental ingestion of fog oil may occur if Indiana bats occasionally groom during non torpid periods during the winter, we assumed the dose of fog oil through this pathway, if it occurs, was extremely low and non toxic.

Mobile Training

No acute or chronic ingestion effects are expected for foraging, roosting or hibernating Indiana bat adults or pups from mobile fog oil training.

9.2.1.3 Dermal Absorption

Static Training

No acute or chronic dermal absorption effects were determined for foraging, roosting, or hibernating Indiana bat adults or pups from static fog oil training.

Mobile Training

No acute or chronic dermal absorption effects were determined for foraging, roosting, or hibernating Indiana bat adults or pups from mobile fog oil training.

9.2.2 Gray Bats

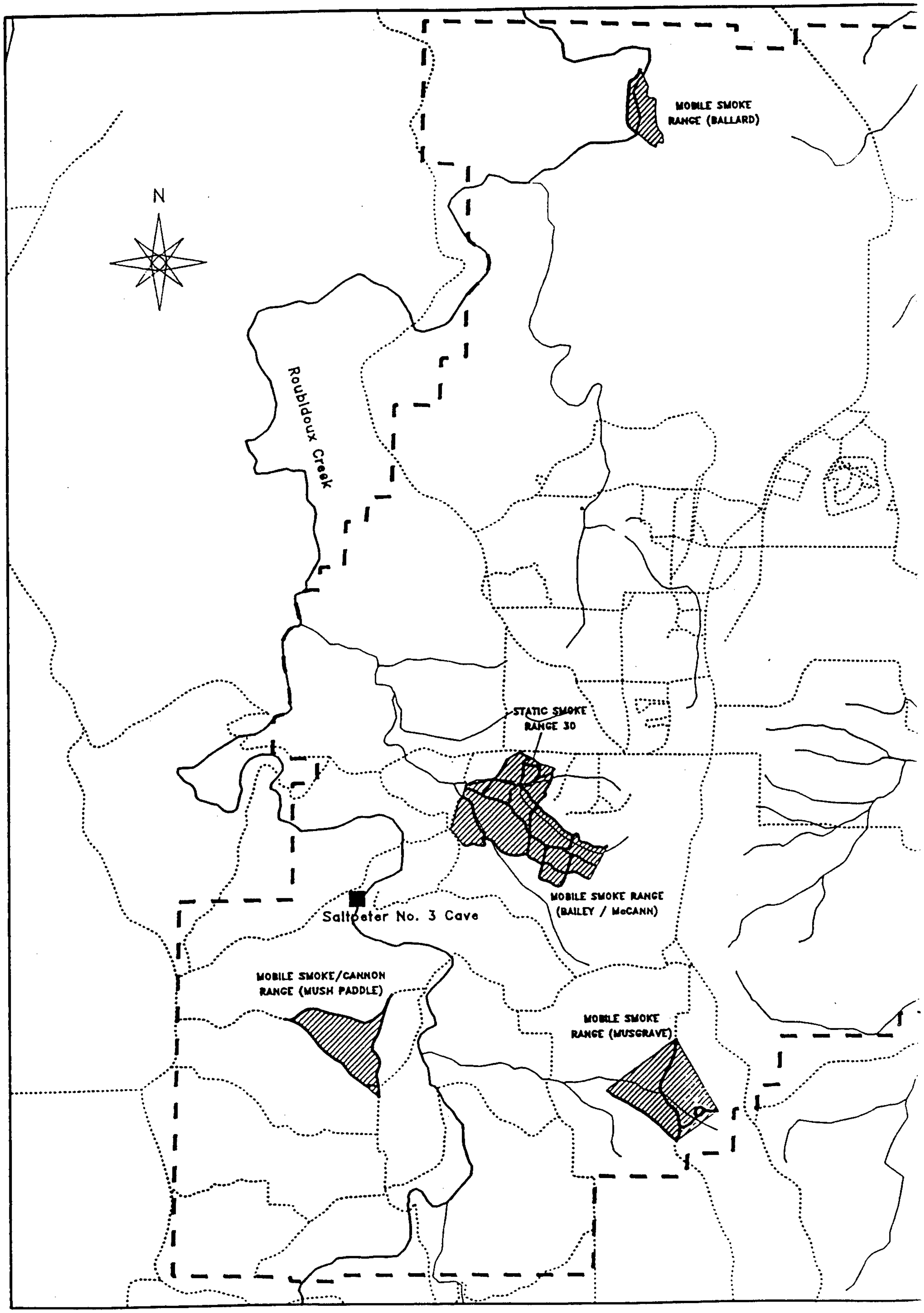
We assessed effects to foraging (installation-wide) and roosting (in maternity caves) bats from fog oil smoke training. Figure 36 presents locations of gray bat caves and fog oil training areas. We assumed nursing pups and supplemental nursing pups occur at the same locations as roosting and foraging adults, respectively. Distances from each training location to gray bat maternity caves are provided in Table 23.

9.2.2.1 Inhalation

Static Training

Gray bats will inhale unsafe concentration of fog oil smoke from static training on Fort Leonard Wood. Foraging gray bats, and gray bats in the maternity colony in Saltpeter No. 3 Cave will be affected.

- No acute inhalation effects from static fog oil training are expected to foraging or roosting gray bats.


N
Roubidoux Creek
MOBILE SMOKE RANGE (BALLARD)
STATIC SMOKE RANGE 30
MOBILE SMOKE RANGE (BAILEY / McCANN)
Saltpeter No. 3 Cave
MOBILE SMOKE/CANNON RANGE (MUSH PADDLE)
MOBILE SMOKE RANGE (MUSGRAVE)

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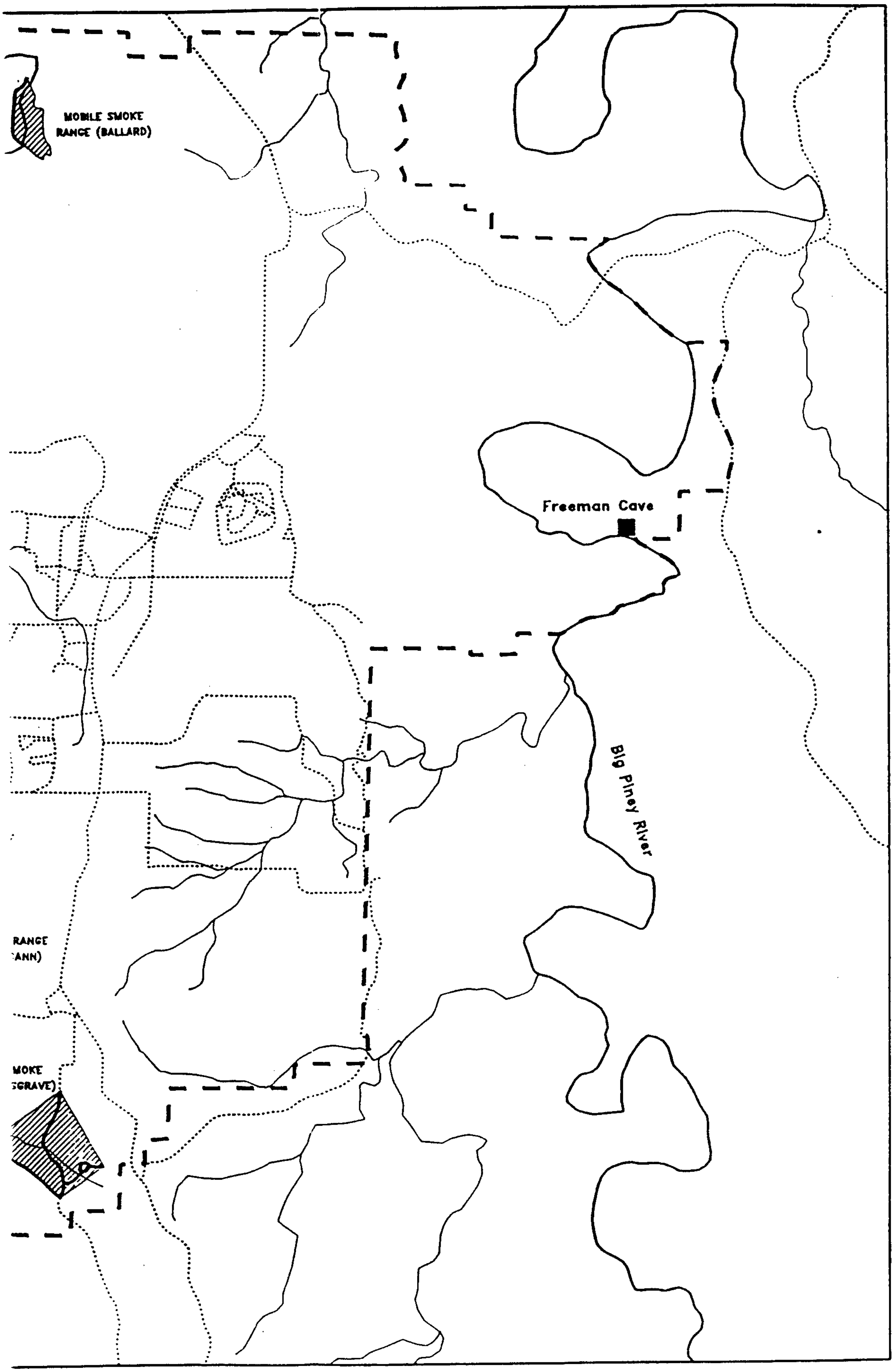

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FIGURE 36. G
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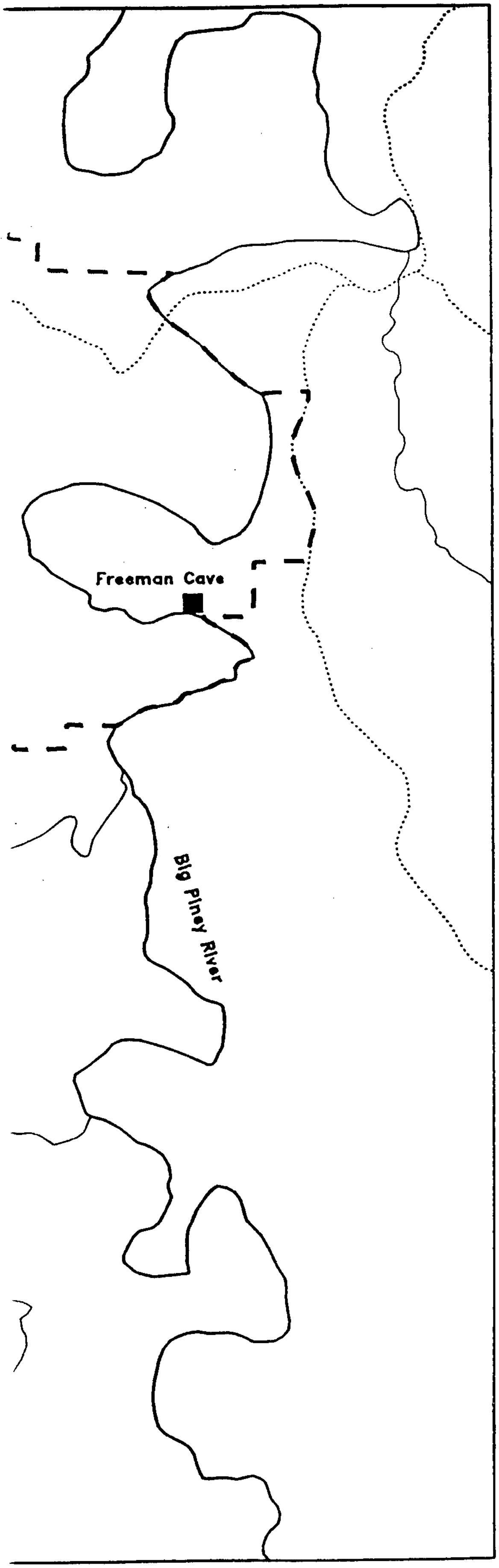


APPENDIX IV TO

BIOLOGICAL ASSESSMENT:

RELOCATION OF U.S. ARMY CHEMICAL SCHOOL AND MILITARY POLICE SCHOOL TO FORT LEONARD WOOD, MISSOURI

FIGURE 36. Gray bat caves and proposed fog oil smoke training locations at Fort Leonard Wood, Missouri.

■ Gray Bat Cave

▨ Offroad Mobile Smoke Training Range

—— Mobile Smoke Deployment Road

Fort Leonard Wood Boundary

········ Road

—— River / Stream

Kilometers

0 2 4

3D/ENVIRONMENTAL

TABLE 23. Distance from gray bat caves to static and mobile fog oil smoke training locations on Fort Leonard Wood, Missouri.

Cave	Fog Oil Smoke Training Location	Distance (m)
Freeman	Static Smoke TA at 30F	12,547
Freeman	Mobile Smoke TA at Musgrave Hollow	13,104
Freeman	Mobile Smoke TA at Cannon Range (Mush Paddle Hollow)	16,542
Freeman	Mobile Smoke TA at Bailey/McCann Hollow	12,024
Freeman	Mobile Smoke TA at Ballard Hollow	11,266
Great Spirit	Static Smoke TA at 30F	9524
Great Spirit	Mobile Smoke TA at Musgrave Hollow	14,973
Great Spirit	Mobile Smoke TA at Cannon Range (Mush Paddle Hollow)	12,357
Great Spirit	Mobile Smoke TA at Bailey/McCann Hollow	9307
Great Spirit	Mobile Smoke TA at Ballard Hollow	7430
Saltpeter No. 3	Static Smoke TA at 30F	3682
Saltpeter No. 3	Mobile Smoke TA at Musgrave Hollow	5462
Saltpeter No. 3	Mobile Smoke TA at Cannon Range (Mush Paddle Hollow)	1751
Saltpeter No. 3	Mobile Smoke TA at Bailey/McCann Hollow	2108
Saltpeter No. 3	Mobile Smoke TA at Ballard Hollow	13,893

- No acute or chronic inhalation effects to nursing or supplemental nursing gray bat pups are expected.
- Gray bats repeatedly foraging within 4000 m of static fog oil generators will inhale concentrations of fog oil resulting in chronic inhalation effects.
- Gray bats repeatedly roosting in Saltpeter No. 3 Cave will inhale unsafe concentrations of fog oil from static smoke training which will result in chronic inhalation effects.

Mobile Training

Gray bats will inhale unsafe concentration of fog oil smoke from mobile training on Fort Leonard Wood. Foraging gray bats, and gray bats in the maternity colony in Saltpeter No. 3 Cave will be affected.

- No acute inhalation effects from mobile fog oil training are expected to foraging or roosting gray bats.
- No acute or chronic inhalation effects to nursing or supplemental nursing gray bat pups are expected.

- Gray bats repeatedly foraging within 7000 m of mobile fog oil generators will inhale concentrations of fog oil resulting in chronic inhalation effects.

- Gray bats repeatedly roosting in Saltpeter No. 3 Cave will inhale unsafe concentrations of fog oil from mobile smoke training on Bailey/McCann, Cannon Range (Mush Paddle Hollow), and Musgrave hollows.

9.2.2.2 Ingestion

Static Training

No acute or chronic ingestion effects were determined for foraging or roosting gray bat adults or nursing pups from static fog oil training.

Mobile Training

No acute or chronic ingestion effects were determined for foraging or roosting gray bat adults, nursing pups, or supplemental nursing young from mobile fog oil training.

9.2.2.3 Dermal Absorption

Static Training

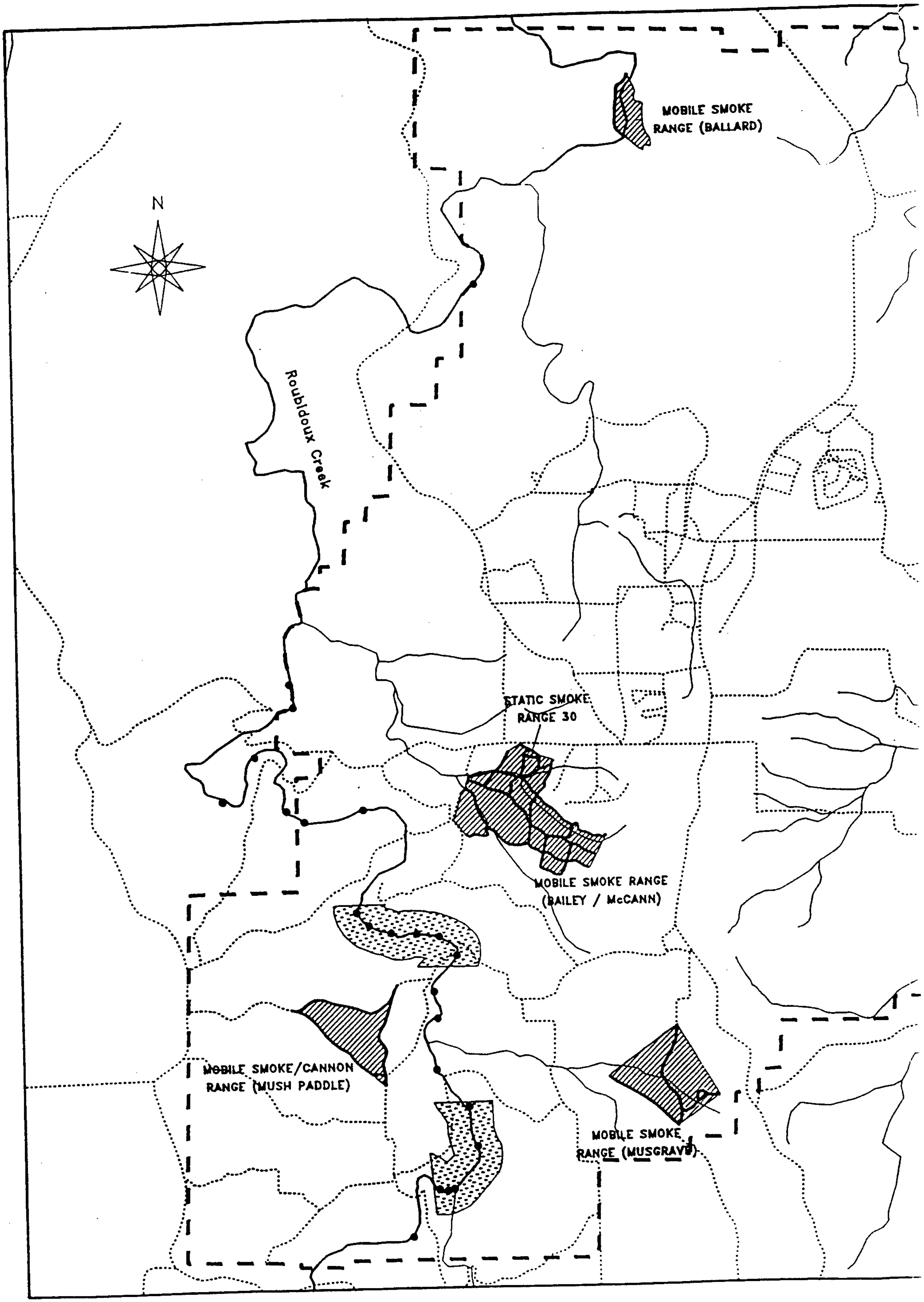
No acute or chronic dermal absorption effects were determined for foraging or roosting gray bat adults, nursing pups, or supplemental nursing young from static fog oil training.

Mobile Training

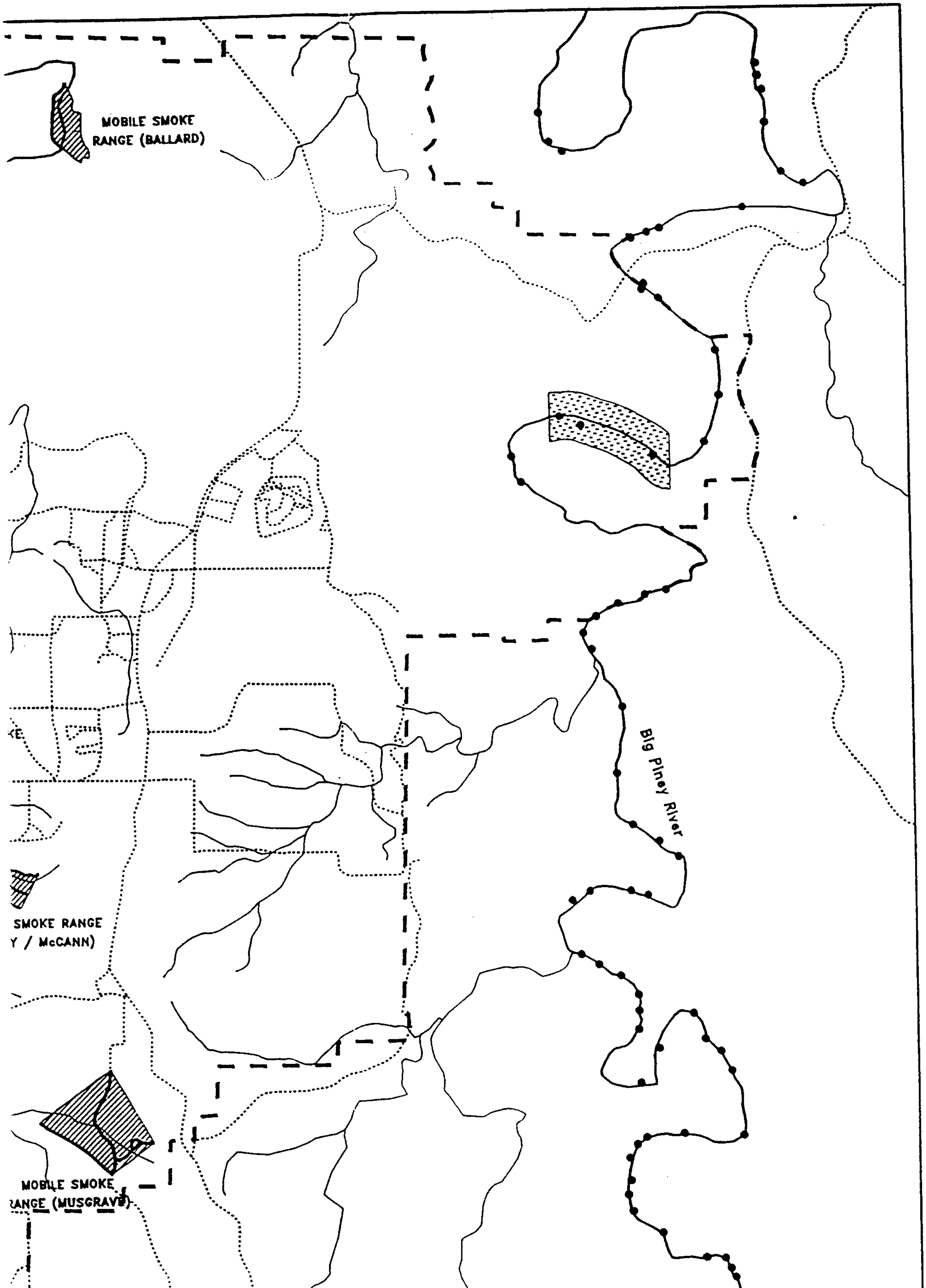
No acute or chronic dermal absorption effects were determined for foraging or roosting gray bat adults, nursing pups, or supplemental nursing young from mobile fog oil training.

9.2.3 Bald Eagles

Bald eagles will not be affected by fog oil smoke training. We evaluated effects to bald eagles foraging (installation-wide) or perching (along the Roubidoux Creek, Big Piney River, or other nearby waterways) on the installation during the winter, and summering eagles in 3 nests near Fort Leonard Wood. We also assessed effects to bald eagle eggs, hatchlings, and juveniles, and determined there were no effects from fog oil training. Figure 37 presents bald eagle sightings, concentration areas, and proposed fog oil smoke training locations on Fort


MOBILE SMOKE RANGE (BALLARD)
N
Roubidoux Creek
STATIC SMOKE RANGE 30
MOBILE SMOKE RANGE (BAILEY / McCANN)
MOBILE SMOKE/CANNON RANGE (MUSH PADDLE)
MOBILE SMOKE RANGE (MUSGRAVE)

(1)



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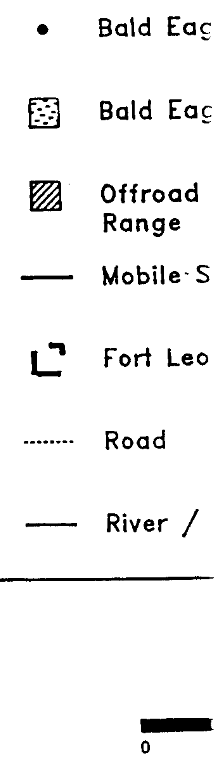

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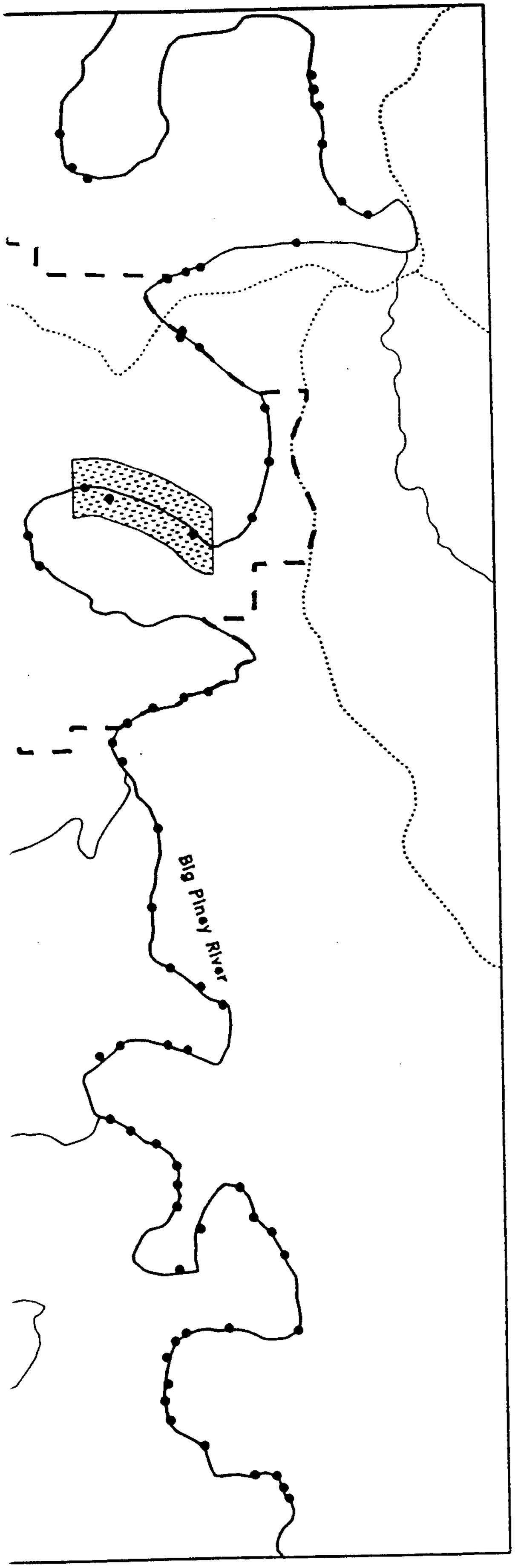

APPENDIX IV TO

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RELOCATION OF U.S. ARMY CHEMICAL SCHOOL AND MILITARY POLICE SCHOOL TO FORT LEONARD WOOD, MISSOURI

FIGURE 37. Bald eagle sightings, concentration areas, and proposed fog oil smoke training locations at Fort Leonard Wood, Missouri.

- Bald Eagle Sighting
- Bald Eagle Concentration Area
- Offroad Mobile Smoke Training Range
- Mobile Smoke Deployment Road
- Fort Leonard Wood Boundary
- Road
- River / Stream

Kilometers

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Leonard Wood. Figure 38 presents locations of 3 bald eagle nests in relation to the fog oil smoke training areas. Table 24 provides distances from the nearest river bank in areas where bald eagle use is documented to smoke training locations. Table 25 provides the distances from each bald eagle nest to fog oil smoke training locations.

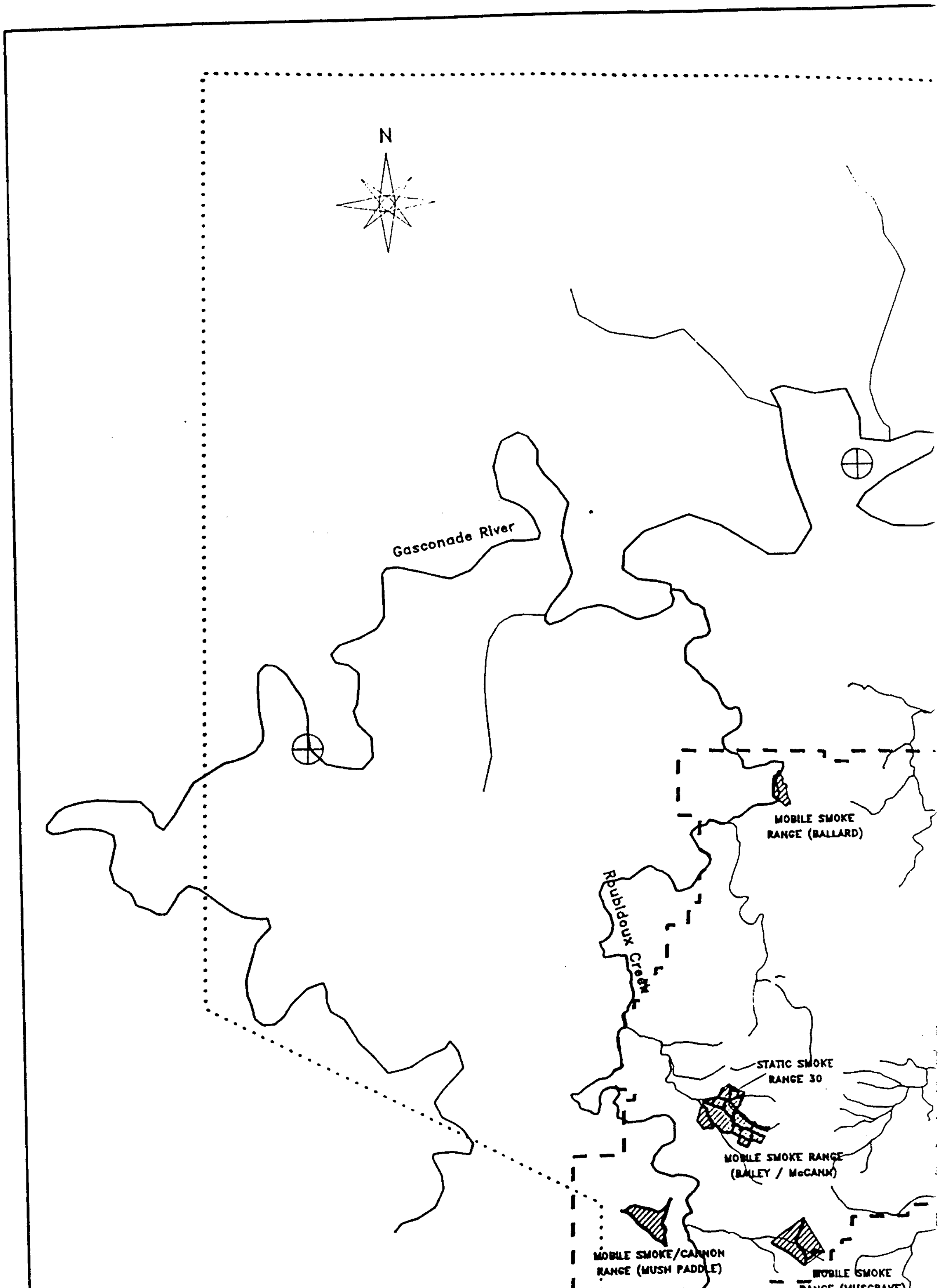
No acute or chronic inhalation, ingestion, or dermal absorption effects were determined for foraging, perching, or nesting bald eagles based on conditions assessed in this study. We do not anticipate any effects from fog oil smoke training to bald eagle adults or other sensitive life cycle stages (eggs, hatchlings, or juveniles).

TABLE 24. Distance from fog oil training locations to waterways where bald eagle use is documented.

Fog Oil Smoke Training Location	Roubidoux Ck.	Big Piney R.
Static Smoke TA at 30F	2500 m	11,000 m
Mobile Smoke TA at Cannon Range (Mush Paddle Hollow)	550 m	14,700 m
Mobile Smoke TA at Bailey/McCann Hollow	800 m	10,250 m
Mobile Smoke TA at Musgrave Hollow	2500 m	11,080 m
Mobile Smoke TA at Ballard Hollow	3275 m	8975 m

TABLE 25. Distance from fog oil training locations to bald eagle nests.

Nest	Fog Oil Smoke Training Location	Distance (m)
South	Static Smoke TA at 30F	20,229
South	Mobile Smoke TA at Musgrave Hollow	25,174
South	Mobile Smoke TA at Cannon Range (Mush Paddle Hollow)	20,749
South	Mobile Smoke TA at Bailey/McCann Hollow	19,717
South	Mobile Smoke TA at Ballard Hollow	17,463
Mid	Static Smoke TA at 30F	23,638
Mid	Mobile Smoke TA at Musgrave Hollow	27,956
Mid	Mobile Smoke TA at Cannon Range (Mush Paddle Hollow)	28,050
Mid	Mobile Smoke TA at Bailey/McCann Hollow	23,623
Mid	Mobile Smoke TA at Ballard Hollow	11,677
North	Static Smoke TA at 30F	45,057
North	Mobile Smoke TA at Musgrave Hollow	48,211
North	Mobile Smoke TA at Cannon Range (Mush Paddle Hollow)	49,712
North	Mobile Smoke TA at Bailey/McCann Hollow	44,956
North	Mobile Smoke TA at Ballard Hollow	34,057


N
Gasconade River
Roubidoux Creek
MOBILE SMOKE
RANGE (BALLARD)
STATIC SMOKE
RANGE 30
MOBILE SMOKE RANGE
(BAILEY / McCANN)
MOBILE SMOKE/CANNON
RANGE (MUSH PADDLE)
MOBILE SMOKE
RANGE (MUSGRAVE)

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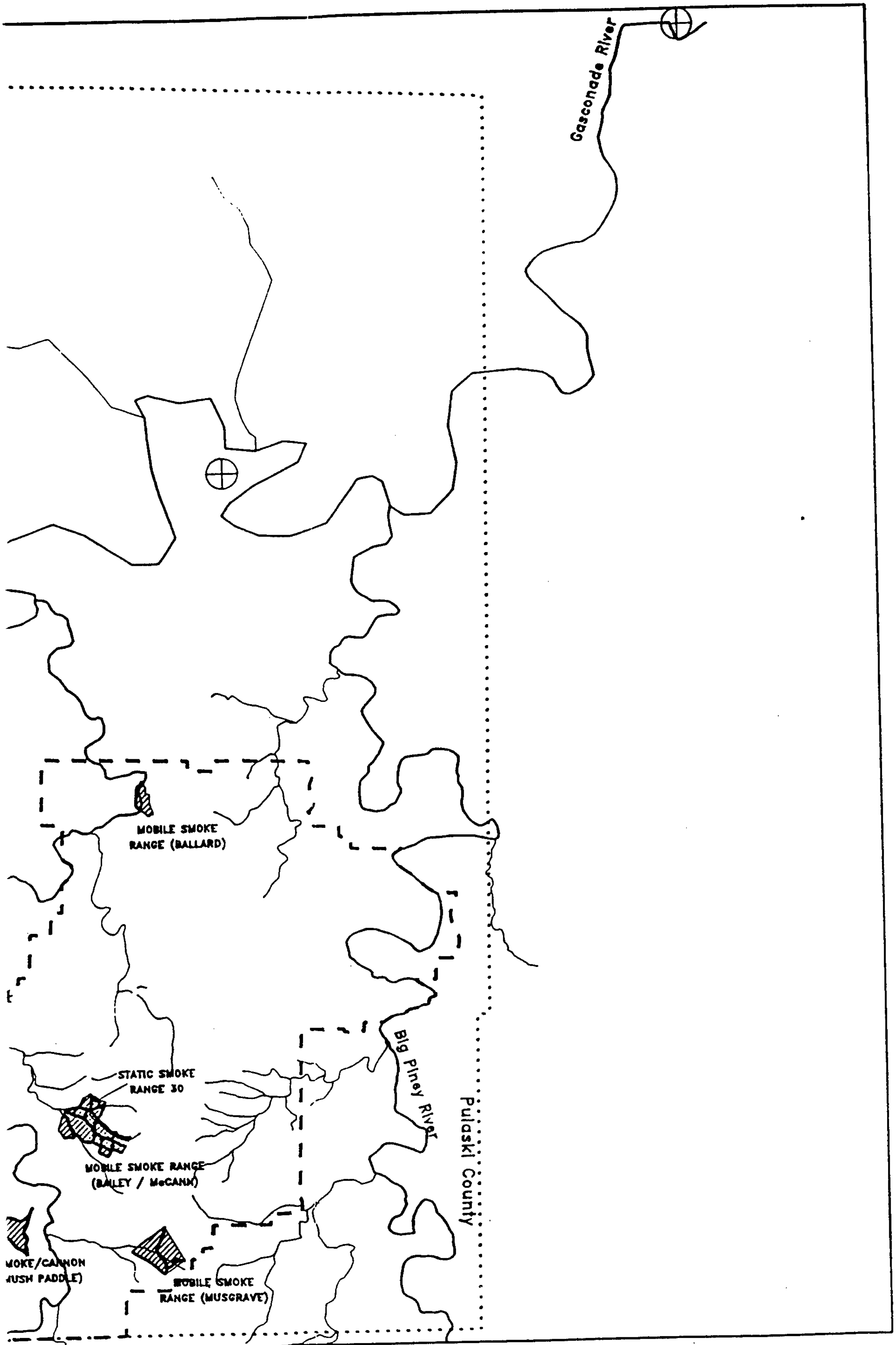

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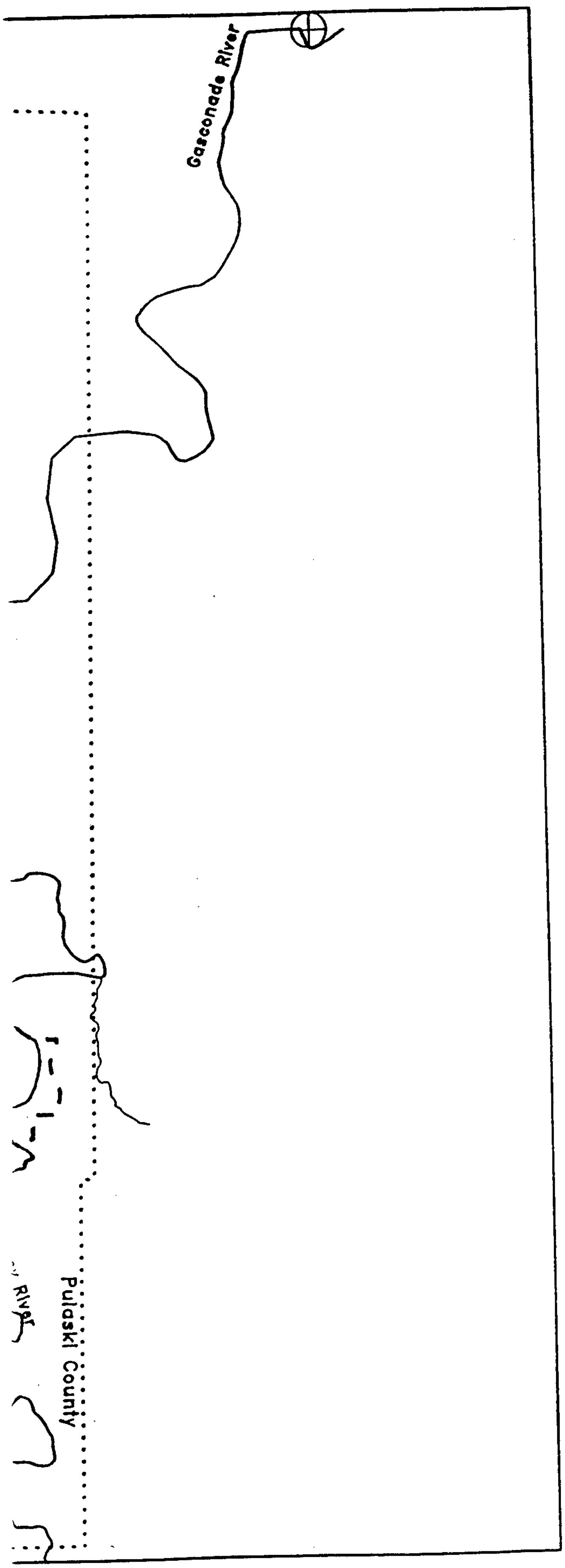

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FIGURE 38. Bald eagle nests and proposed fog oil smoke training locations at Fort Leonard Wood, Missouri.

Bald Eagle Nest

Offroad Mobile Smoke Training Range

Mobile Smoke Deployment Road

Fort Leonard Wood Boundary

County Boundary

River / Stream

Kilometers

0 5 10

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9.3 RISK OF EXPOSURE TO TEREPHTHALIC ACID GRENADES AND SMOKE POTS

We determined the ingestion and dermal absorption pathways were incomplete for all three receptors from TPA grenades and TPA smoke pots. The following discussion details effects from inhaling TPA smoke. We considered exposures last 2.5 minutes for grenades and smoke pots. This is based on expected burn time of each. While TPA smoke may remain in the air after the source is depleted, the exposure concentrations used in our calculations were peak (greatest) concentrations, and result in doses higher than what would be received by receptors exposed to a mean contaminant concentration for 10 minutes (the estimated time TPA smoke clouds exist).

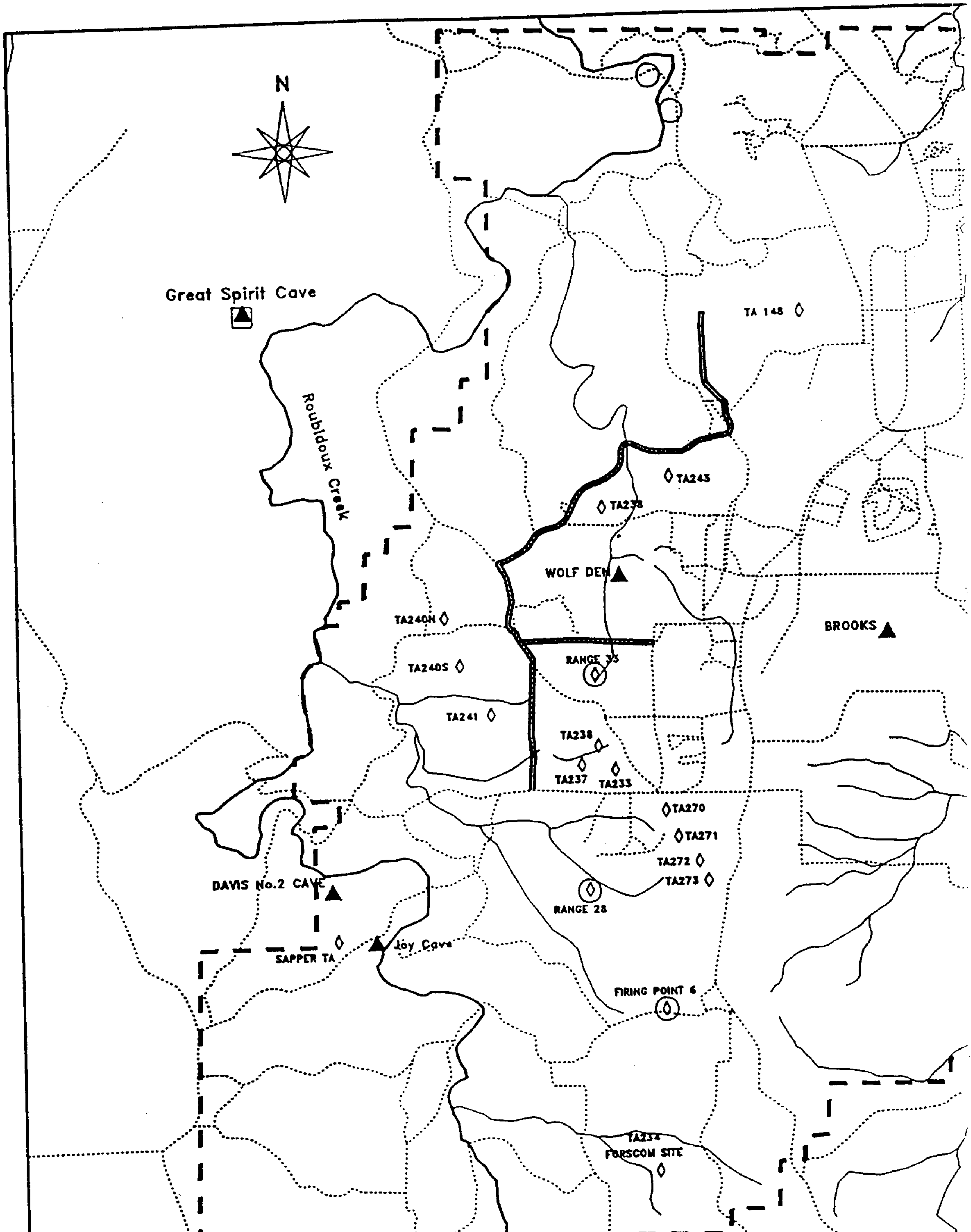
9.3.1 TPA Grenades

9.3.1.1 Indiana Bat - Inhalation

Indiana bats will be affected by TPA grenades on Fort Leonard Wood. Grenades will be deployed at 22 locations on Fort Leonard Wood (Figure 39). Indiana bat hibernacula are between 650 m and 13,270 m from grenade training ranges (Figure 39). Table 26 presents the distance from Indiana bat hibernacula to central points within each grenade use area. Great Spirit Cave was omitted from this table because it is over 3000 m from the Installation boundary. We assessed effects of TPA grenades to foraging and roosting (installation-wide) and hibernating (in hibernacula) Indiana bats. We assessed effects to adults, nursing pups, and supplemental nursing young. We assumed nursing young and supplemental nursing young occur at the same locations as summer roosting and foraging adults, respectively.

Indiana bats will inhale unsafe concentrations of TPA from grenades.

- Adult Indiana bats, nursing pups, and supplemental nursing pups foraging or roosting within 3000 m of any TPA grenade training location will inhale unsafe concentrations of TPA smoke and exhibit acute toxicological effects.
- Indiana bats repeatedly foraging or roosting within 3000 m of TPA grenade training location will inhale unsafe concentrations of TPA and exhibit chronic toxicological effects.


N
Great Spirit Cave
Roubidoux Creek
TA 148
TA243
WOLF DEN
TA240N
BROOKS
RANGE 33
TA240S
TA241
TA238
TA237
TA233
TA270
TA271
TA272
TA273
RANGE 28
DAVIS No.2 CAVE
SAPPER TA
Joy Cave
FIRING POINT 6
TA234
FORSCOM SITE

1

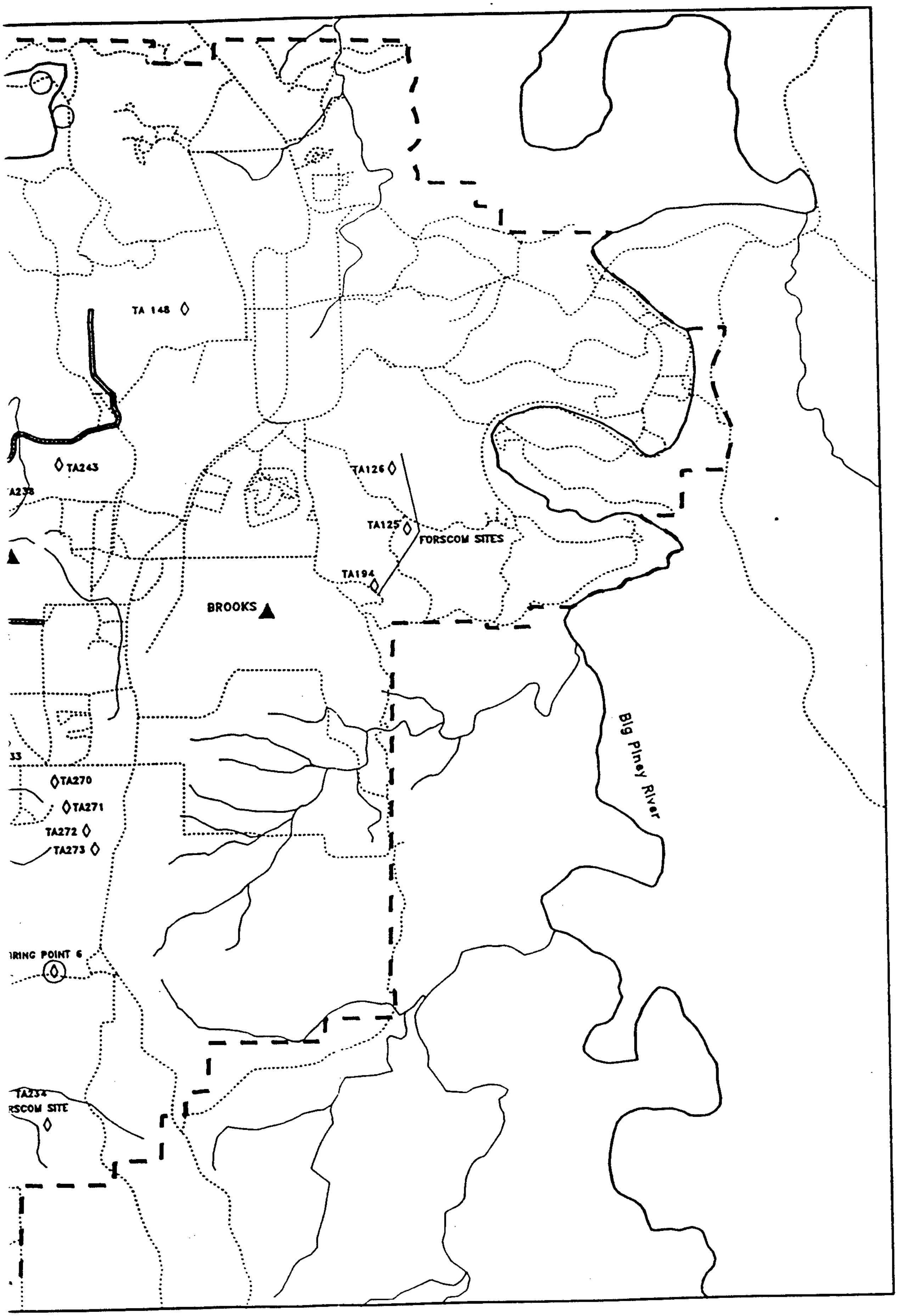


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FIGURE 39.
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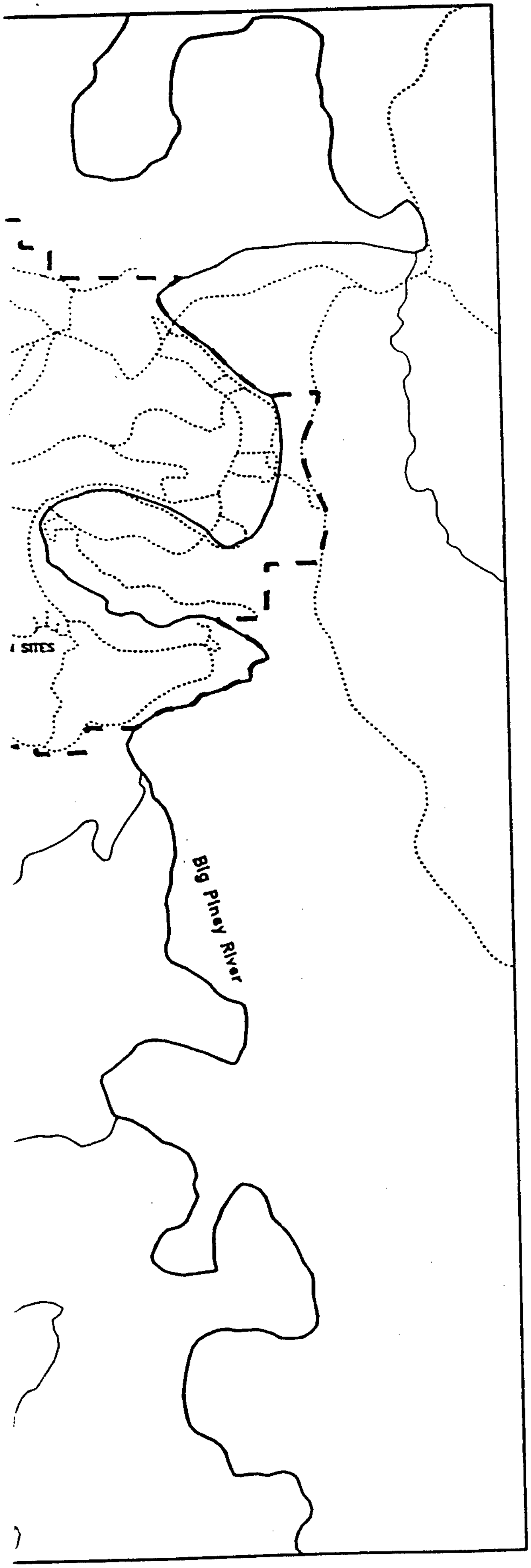

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FIGURE 39. Indiana bat hibernacula and proposed smoke pot and smoke grenade training locations at Fort Leonard Wood, Missouri.

▲ Indiana Bat Hibernaculum

Indiana Bat Hibernaculum/ Gray Bat Cave

○ Smoke Pot Use Area

◊ Smoke Grenade Use Area

Smoke Grenade Training Road

Fort Leonard Wood Boundary

Road

River / Stream

Kilometers
0 2 4

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TABLE 26. Distance (m) from central points within grenade use locations to Indiana bat hibernacula on Fort Leonard Wood.

Grenade Use Location	Wolf Den Cave	Davis No. 2 Cave	Brooks Cave	Joy Cave
TA 148	5220	12,290	5430	12,530
243	1820	8870	4450	9130
238	1170	7780	5180	8130
240N	3030	4900	7390	5500
240S	3070	4300	7150	4790
241	3150	3950	6740	4240
Range 33	1690	5660	4920	5740
238B	2820	5050	5160	4940
233	3180	5130	5050	4910
237	3180	4650	5540	4520
270	3930	5730	4680	5310
271	4400	5840	4820	5340
272	4880	6140	4880	5550
273	5230	6270	5040	5630
Range 28	5200	4270	6520	3650
FP 6	7190	5890	7200	4940
Sapper TA	7660	810	10,470	650
TA 126	6790	13,270	3310	13,120
125	6900	13,000	2830	12,760
194	6330	12,080	1930	11,790
234	9810	7110	9610	6000
Road	1080	3730	3880	3640

- Indiana bats hibernating in Davis No. 2, Joy, Brooks, and Wolf Den will inhale unsafe concentrations of TPA and exhibit acute toxicological effects. Table 27 presents specific TPA grenade training areas from which unsafe TPA concentrations will reach Indiana bat hibernacula.

9.3.1.2 Gray Bat - Inhalation

Gray bats will inhale unsafe concentrations of TPA from grenades while foraging (installation-wide) or roosting in maternity colonies on Fort Leonard Wood, Missouri. Figure 40 presents the location of TPA grenade use areas in relation to Freeman and Saltpeter No. 3 gray bat caves. Great Spirit Cave was omitted from this table because it is over 3000 m from the Installation boundary. We assessed effects to adults, nursing pups, and supplemental

TABLE 27. TPA grenade training locations within 3000 m of Indiana bat hibernacula. Chronic and acute inhalation effects to Indiana bats in hibernacula are based on the concentration of TPA in the cave.

Grenade Use Location	Indiana Bat Hibernacula			
	Wolf Den	Davis No. 2	Brooks	Joy
TA 243	yes			
TA 238	yes			
Range 33	yes			
TA 238B	yes			
Sapper TA		yes		yes
TA 125			yes	
TA 194			yes	
Road	yes			

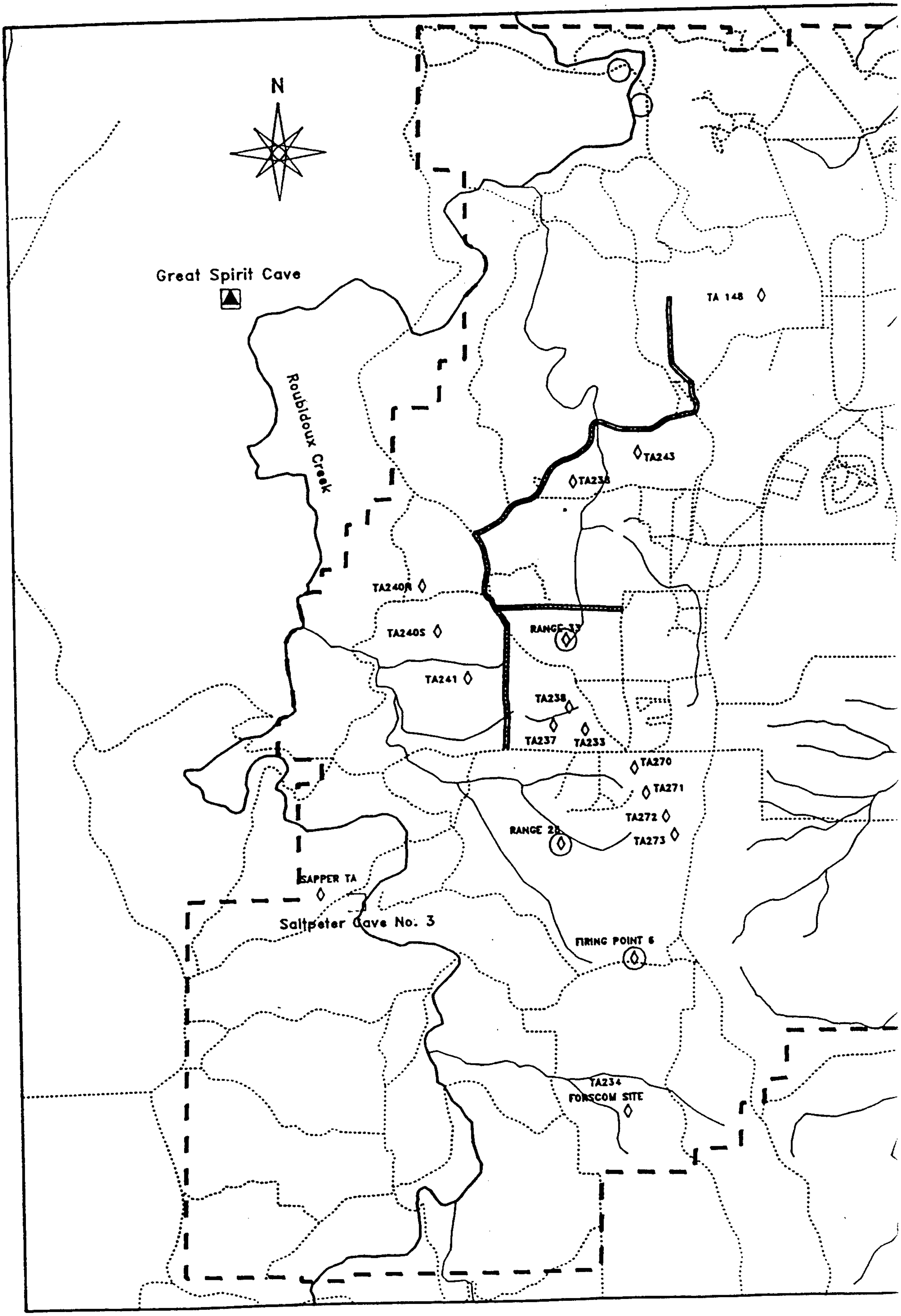
nursing pups. We assumed nursing young and supplemental nursing young occur at the same locations as summer roosting and foraging adults, respectively. Table 28 presents the distance from gray bat caves to central points within each grenade use area.

Gray bats will be affected by inhaling unsafe concentrations of TPA from grenades while foraging or roosting in maternity caves on Fort Leonard Wood.

- Adult gray bats and supplemental nursing young foraging within 3000 m of any of the 22 TPA grenade training locations will inhale unsafe concentrations of TPA smoke and exhibit acute toxicological effects.

- Gray bats repeatedly foraging within 3000 m of any of the 22 TPA grenade training locations will inhale unsafe concentrations of TPA and exhibit chronic toxicological effects.

- Adult gray bats, nursing young, and supplemental nursing young in Saltpeter No. 3 Cave will inhale unsafe concentrations of TPA from grenades released at 1 of 22 grenade training locations and exhibit acute toxicological effects. Table 29 presents specific TPA grenade training areas from which unsafe TPA concentrations will reach gray bat caves.



N
Great Spirit Cave
Roubidoux Creek
TA 148
TA243
TA240N
TA240S
TA241
TA238
TA237
TA233
TA270
TA271
TA272
TA273
SAPPER TA
Saltpeter Cave No. 3
FIRING POINT 6
TA234
FORSCOM SITE

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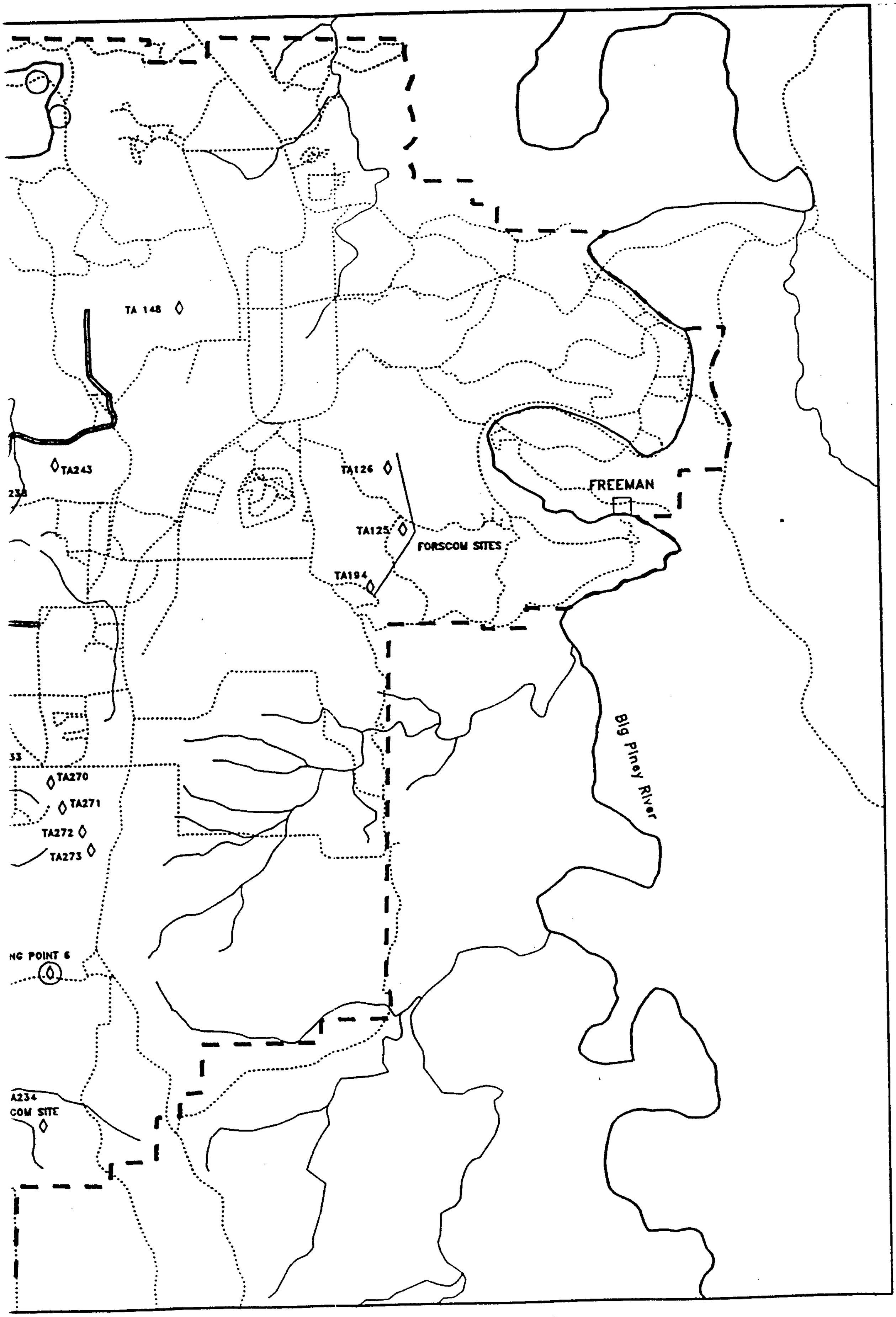

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FIGURE 40.
proposed smoke
training locations
Missouri.

- Gray Bat C
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- Smoke Pot
- Smoke Gre
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- Fort Leona
- Road
- River / St

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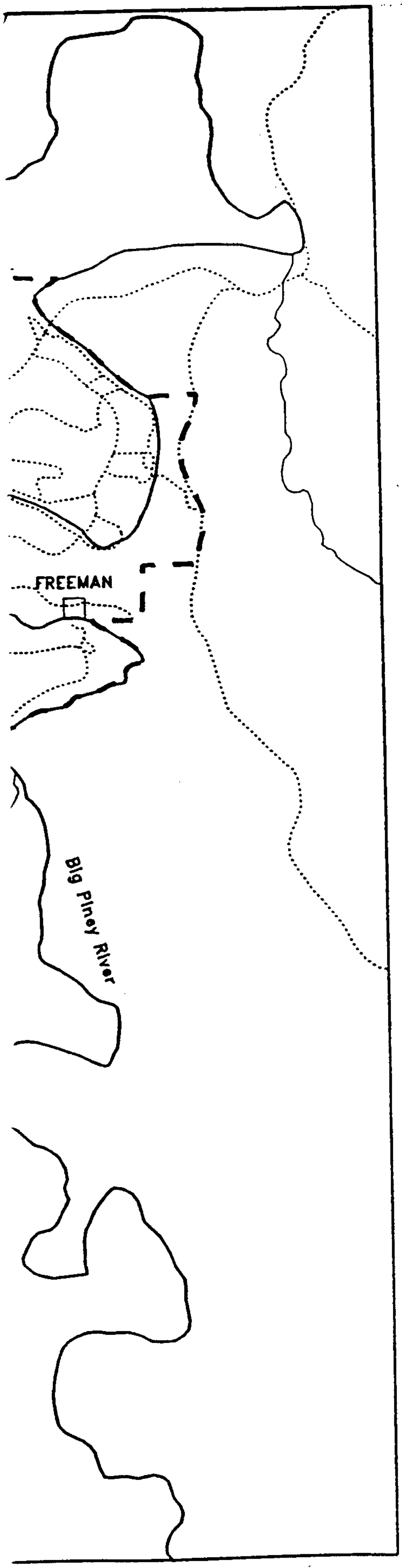

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FIGURE 40. Gray bat caves and proposed smoke pot and smoke grenade training locations at Fort Leonard Wood, Missouri.

□ Gray Bat Cave

Indiana Bat Hibernaculum/ Gray Bat Cave

○ Smoke Pot Use Area

◊ Smoke Grenade Use Area

Smoke Grenade Training Road

Fort Leonard Wood Boundary

...... Road

— River / Stream

Kilometers
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TABLE 28. Distances from central points within grenade use locations to gray bat caves on Fort Leonard Wood.

Grenade Use Location	Gray Bat Caves	
	Saltpeter No. 3 (m)	Freeman (m)
TA 148	12,600	8360
243	9200	9850
238	8200	10,950
240N	5580	13,690
240S	4870	13,540
241	4310	13,210
Range 33	5810	11,360
238B	5000	11,620
233	4970	11,490
237	4570	12,000
270	5350	10,970
271	5370	10,990
272	5580	10,890
273	5650	10,930
Range 28	3680	12,720
FP 6	4930	12,750
Sapper TA	660	16,850
TA 126	13,170	4080
125	12,810	3790
194	11,830	4550
234	5960	14,640
Road	3730	9210

TABLE 29. TPA grenade training locations within 3000 m of gray bat caves. Chronic and acute inhalation effects to gray bats in caves are based on the concentration of TPA that reaches the cave.

Grenade Use Location	Saltpeter No. 3 Cave
Sapper TA	yes

- Gray bats repeatedly roosting in Saltpeter No. 3 Cave will inhale unsafe concentrations of TPA from grenades released at 1 of the 22 grenade training locations and exhibit chronic toxicological effects (Table 29).

9.3.1.3 Bald Eagle - Inhalation

Bald eagles will be affected by TPA grenades on Fort Leonard Wood. Wintering adult and juvenile bald eagles will inhale unsafe concentrations of TPA from grenades while traveling (installation-wide) or perching/foraging (along the Roubidoux Creek or Big Piney River). Figure 41 presents locations of TPA grenade use in relation to bald eagle sightings and concentration areas on the Big Piney River and Roubidoux Creek. Table 30 presents distances measured from the Roubidoux Creek and Big Piney River to central points within the 22 grenade training areas. We assessed effects to adult, juvenile, and hatchling bald eagles, as well as bald eagle eggs. We assumed juveniles occur at the same locations as adults. We calculated exposures assuming hatchlings and eggs occur at each of three known nest sites.

TPA released from grenades will not affect summering bald eagles in nests because unsafe concentrations of TPA will not reach eagle nests. All three bald eagle nest are greater than 3000 m from the installation boundary. Bald eagle eggs and hatchlings will not be affected.

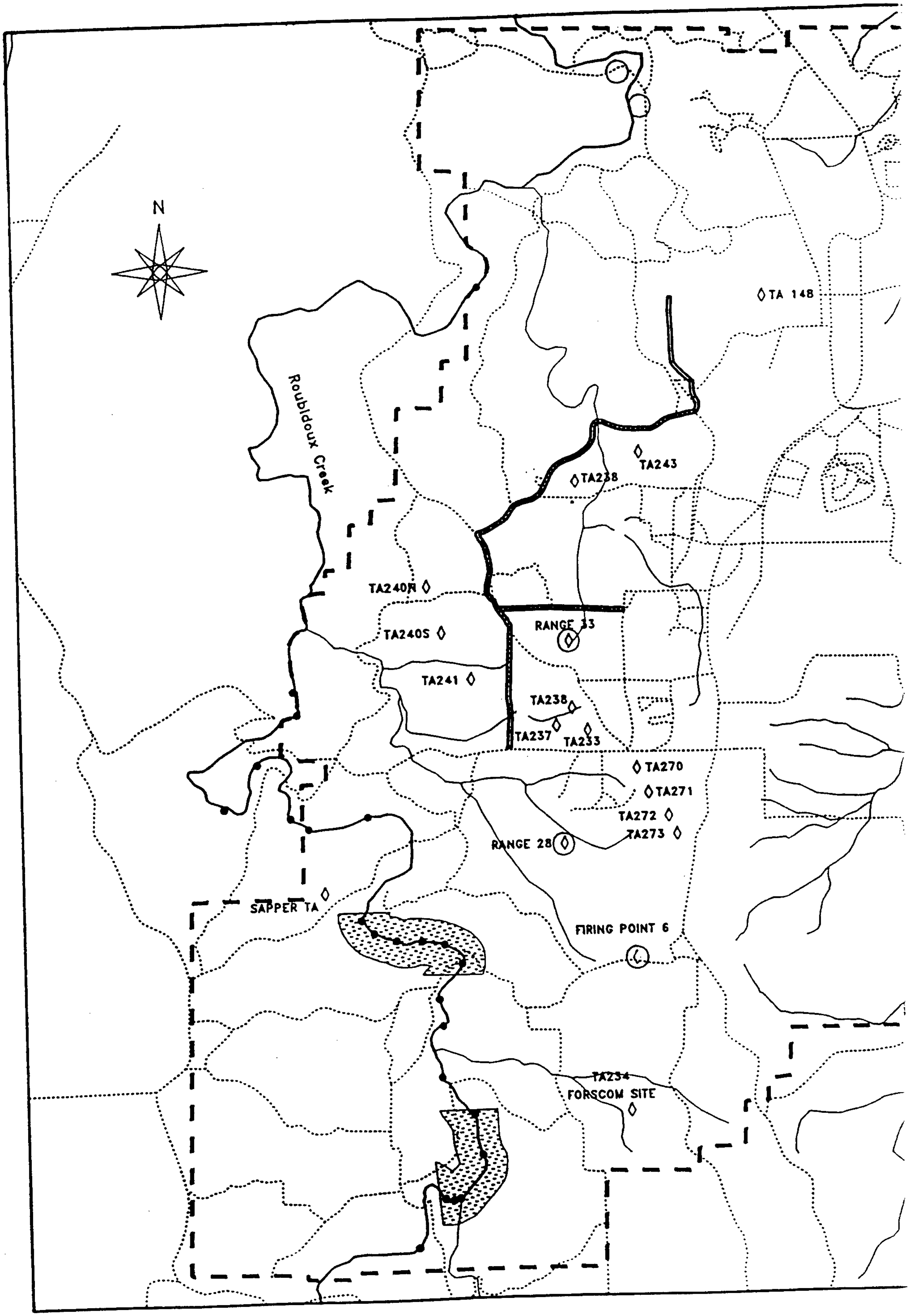
Bald eagles will inhale unsafe concentrations of TPA released from grenades on Fort Leonard Wood.

- Wintering juvenile and adult bald eagles traveling, foraging, or perching within 3000 m of any TPA grenade training location will inhale unsafe concentrations of TPA smoke and exhibit acute toxicological effects (Table 31).

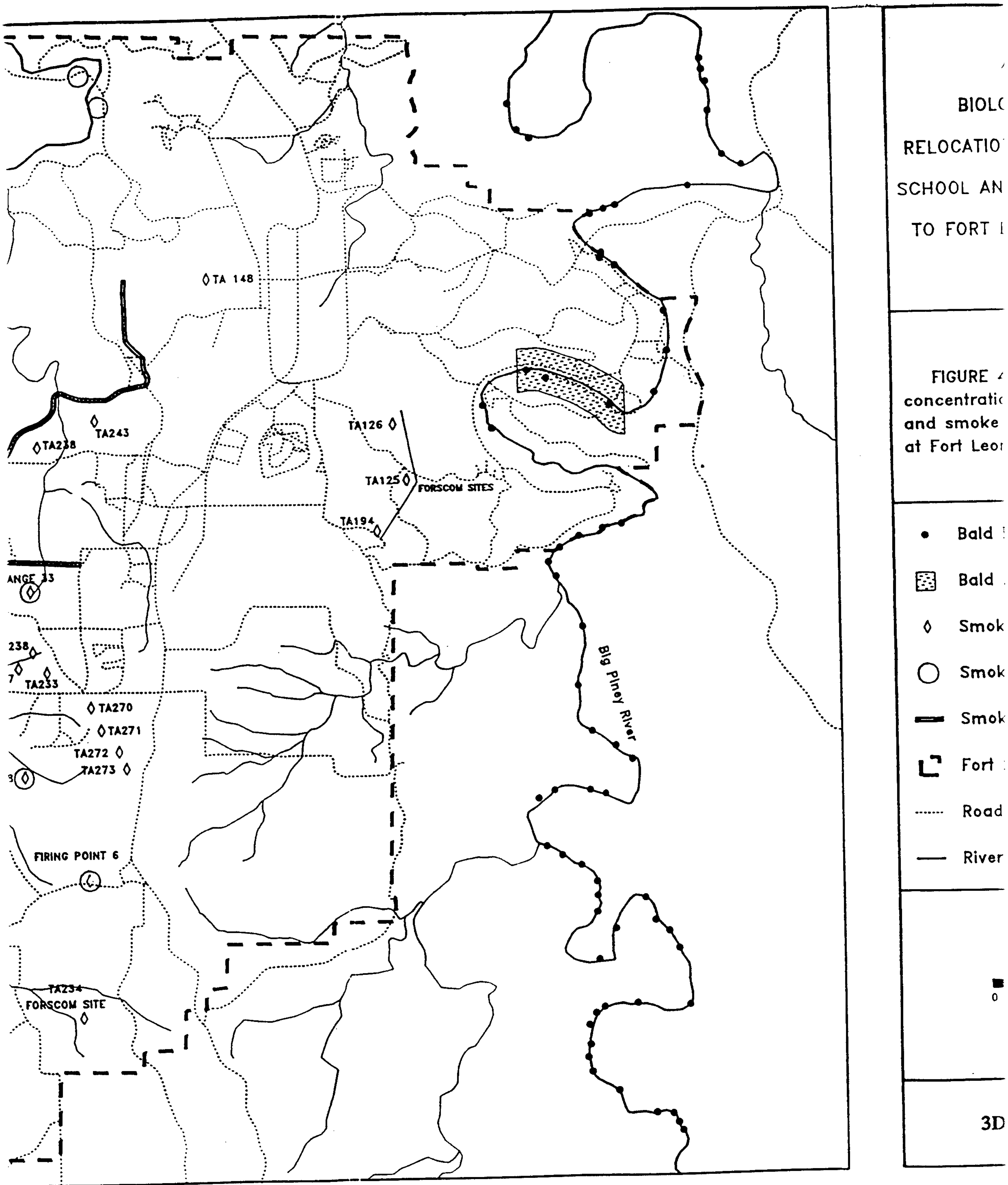
- No chronic effects are anticipated for bald eagles from TPA grenade training.

9.3.2 TPA Smoke Pots

TPA smoke pots will be used at the 4 mobile smoke ranges (Figure 7) and at 5 other locations (Figure 39).


N
Roubidoux Creek
TA 148
TA243
TA238
TA240N
TA240S
RANGE 33
TA241
TA238
TA237
TA233
TA270
TA271
TA272
TA273
RANGE 28
SAPPER TA
FIRING POINT 6
TA234
FORSCOM SITE

(1)


TA 148
TA126
TA125
FORSCOM SITES
TA194
TA243
TA238
ANGE 33
238
7
TA233
TA270
TA271
TA272
TA273
3
FIRING POINT 6
TA234
FORSCOM SITE
Big Piney River
BIOL
RELOCATIO
SCHOOL AN
TO FORT
FIGURE
concentratio
and smoke
at Fort Leo
Bald
Bald
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Fort
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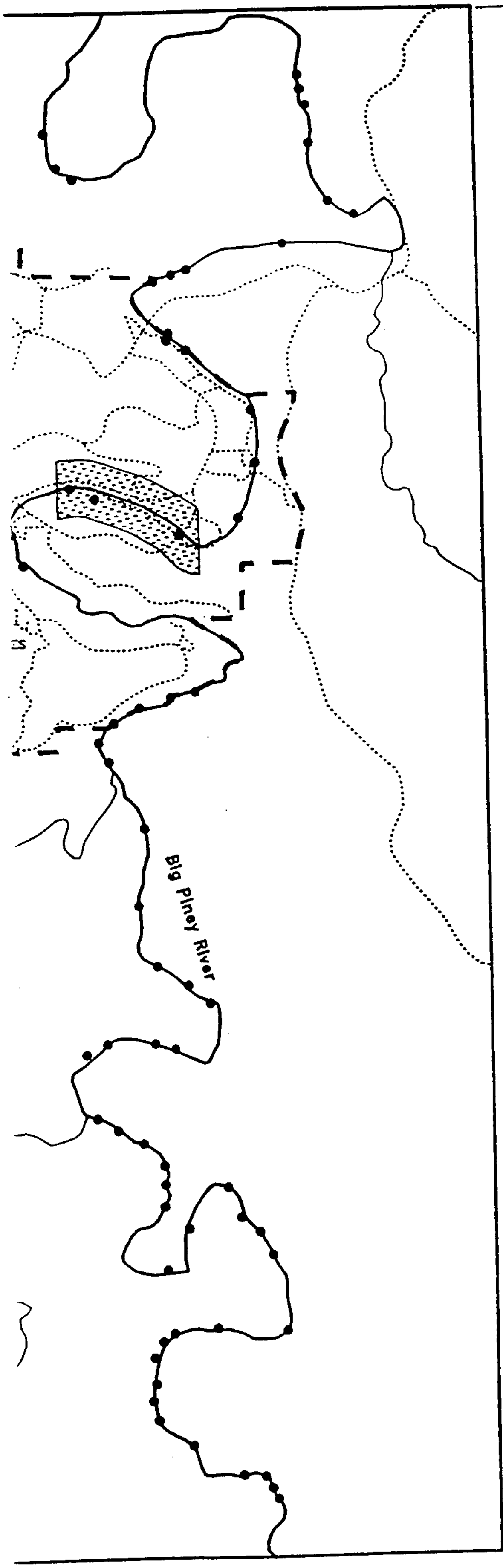


APPENDIX IV TO

BIOLOGICAL ASSESSMENT:

RELOCATION OF U.S. ARMY CHEMICAL SCHOOL AND MILITARY POLICE SCHOOL TO FORT LEONARD WOOD, MISSOURI

FIGURE 41. Bald eagle sightings, concentration areas, and smoke pot and smoke grenade training locations at Fort Leonard Wood, Missouri.

- Bald Eagle Sighting
- Bald Eagle Concentration Area
- Smoke Grenade Use Area
- Smoke Pot Use Area
- Smoke Grenade Training Road
- Fort Leonard Wood Boundary
- Road
- River / Stream

Kilometers

0 2 4

3D/ENVIRONMENTAL

TABLE 30. Distances from central points within grenade use locations to the Roubidoux Creek and Big Piney River.

Grenade Use Location	Bald Eagle Perching /Foraging Habitat	
	Roubidoux Creek	Big Piney River
TA 148	4860	5760
243	3970	7490
238	3470	8680
240N	1820	11,590
240S	2320	11,550
241	2720	11,290
Range 33	4280	9430
238B	3560	9850
233	3590	9690
237	3160	10,240
270	4130	8660
271	4240	8390
272	4370	7980
273	4320	7780
Range 28	2640	9760
FP 6	3090	8520
Sapper TA	750	13,880
TA 126	8030	1770
125	8960	1900
194	9690	2940
234	2750	9740
Road	2650	6840

TABLE 31. TPA grenade training locations within 3000 m of bald eagle perching/foraging habitat. Chronic and acute inhalation effects from TPA grenades extend 3000 m from the source.

Grenade Use Location	Roubidoux Creek	Big Piney River
240N	yes	
240S	yes	
241	yes	
Range 28	yes	
Sapper TA	yes	
TA 126		yes
TA 125		yes
TA 194		yes
TA 234	yes	
Road	yes	

9.3.2.1 Indiana Bat Inhalation

Indiana bats will inhale unsafe concentrations of TPA released from smoke pots. We evaluated effects to hibernating and foraging/roosting Indiana bats that will inhale unsafe concentrations of TPA from smoke pots. Several TPA smoke pot training locations are near Indiana bat hibernacula (Figure 39). Table 32 indicates distances from TPA smoke pot use areas to hibernacula. Great Spirit Cave was omitted from this table because it is over 3000 m from the Installation boundary. Table 22 presents distances from mobile fog oil smoke training areas where TPA smoke pots are used, to Indiana bat hibernacula. We assessed effects to adults, nursing pups, and supplemental nursing pups. We assumed nursing young and supplemental nursing young occur at the same locations as summer roosting and foraging adults, respectively.

- Adult Indiana bats, nursing pups, and supplemental nursing pups foraging or roosting within 3000 m of any of the 9 TPA smoke pot training locations will inhale unsafe concentrations of TPA smoke and exhibit acute toxicological effects.

- Indiana bats repeatedly foraging or roosting within 3000 m of any of the 9 TPA smoke pot training locations will inhale unsafe concentrations of TPA and exhibit chronic toxicological effects.

TABLE 32. Distance from smoke pot use locations to Indiana bat hibernacula on Fort Leonard Wood. Distances to smoke pot use areas outside mobile smoke areas are to a central point within the smoke pot use area.

Smoke Pot Use Location	Indiana Bat Hibernacula			
	Brooks	Davis No. 2	Wolf Den	Joy
Cannon Range (Mush Paddle Hollow)	10,335	2889	8432	1803
Bailey McCann Hollow	5803	2423	3861	2045
Musgrave Hollow	8031	6624	8609	5499
Ballard Hollow	8449	13,352	6859	13,821
FP 6	7204	5885	7191	4942
Range 28	6516	4274	5202	3650
Range 33	4918	5658	1685	5743
Ballard - In	9231	13,987	7608	14,525
Ballard - Out	9913	14,371	8150	14,926

- Indiana bats hibernating in Davis No. 2, Joy, and Wolf Den caves will inhale unsafe concentrations of TPA and exhibit acute toxicological effects. Table 33 presents the specific TPA smoke pot training areas from which unsafe TPA concentrations will reach Indiana bat hibernacula.

9.3.2.2 Gray Bat - Inhalation

Gray bats will inhale unsafe concentrations of TPA from smoke pots on Fort Leonard Wood while foraging (installation-wide) or roosting in caves. Several TPA smoke pot use areas are near gray bat caves (Figure 40). Table 34 presents distances from smoke pot use areas to gray bat caves on Fort Leonard Wood. Great Spirit Cave was omitted from this table because it is over 3000 m from the Installation boundary. We assessed effects to adults, nursing pups, and supplemental nursing pups. We assumed nursing young and supplemental nursing young occur at the same locations as summer roosting and foraging adults, respectively.

Gray bats will be affected by inhaling unsafe concentrations of TPA from smoke pots while foraging or roosting in caves on Fort Leonard Wood.

- Adult and supplemental nursing gray bat young foraging within 3000 m of any of the 9 TPA smoke pot training locations will inhale unsafe concentrations of TPA smoke and exhibit acute toxicological effects.

TABLE 33. TPA smoke pot training locations, as listed in Table 32, within 3000 m of Indiana bat hibernacula. Chronic and acute inhalation effects to Indiana bats in hibernacula are based on the concentration of TPA in the cave.

Smoke Pot Use Location	Indiana Bat Hibernacula		
	Davis No. 2	Wolf Den	Joy
Range 33		yes	
Cannon Range (Mush Paddle Hollow)	yes		yes
Bailey/McCann Hollow	yes		yes

TABLE 34. Distances from pot use locations to gray bat caves on Fort Leonard Wood. Distances to smoke pot use area outside mobile smoke areas are to a central point in the deployment area.

Smoke Pot Use Location	Gray Bat Cave (m)	
	Saltpeter No. 3	Freeman
Cannon Range (Mush Paddle Hollow)	1751	16,542
Bailey McCann Hollow	2108	12,024
Musgrave Hollow	5462	13,104
Ballard Hollow	13,893	11,266
FP 6	4932	12,751
Range 28	3677	12,718
Range 33	5808	11,361
Ballard - In	14,578	11,814
Ballard - Out	15,002	12,460

- Gray bats repeatedly foraging within 3000 m of any of the 9 TPA smoke pot training locations will inhale unsafe concentrations of TPA and exhibit chronic toxicological effects.

- Gray bats in Saltpeter No. 3 Cave will inhale unsafe concentrations of TPA from smoke pots released at 2 of the 9 smoke pot training locations and exhibit acute toxicological effects (Table 35).

- Gray bats repeatedly roosting in Saltpeter No. 3 Cave will inhale unsafe concentrations of TPA from grenades released at 2 of the 9 smoke pot training locations and exhibit chronic toxicological effects (Table 35).

TABLE 35. TPA smoke pot training locations within 3000 m of gray bat caves. Chronic and acute inhalation effects to gray bats in caves are based on the concentration of TPA in the cave.

Smoke Pot Use Location	Saltpeter No. 3
Cannon Range (Mush Paddle Hollow)	yes
Bailey/McCann Hollow	yes

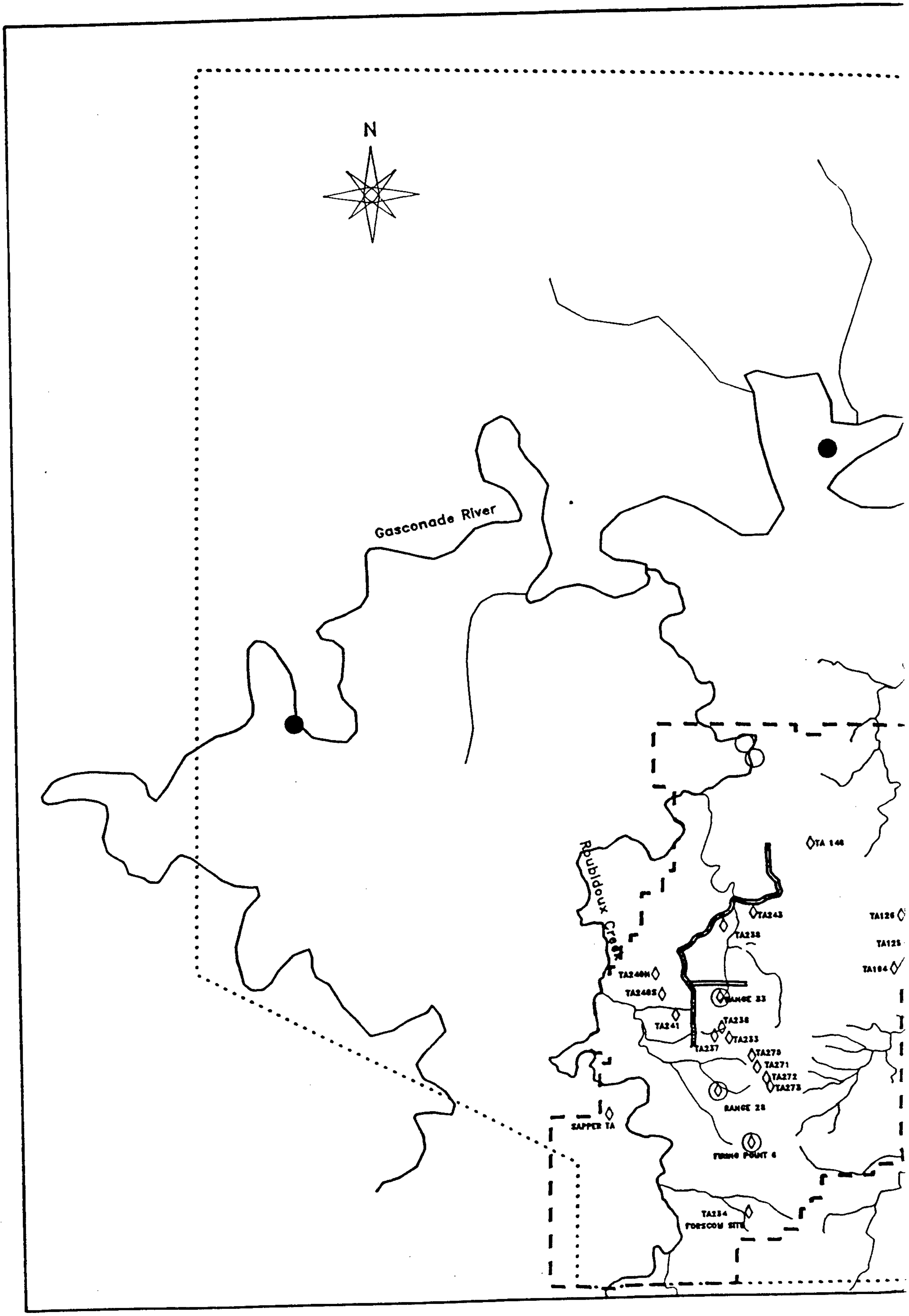
9.3.2.3 Bald Eagle - Inhalation

Bald eagles will inhale unsafe concentrations of TPA released from smoke pots on Fort Leonard Wood. We assessed effects to adult and juvenile wintering bald eagles traveling (installation-wide) and perching/foraging (along the Roubidoux Creek and Big Piney River) and summer bald eagles in 3 nests along the Gasconade River. Figure 41 presents the spatial relationship of 5 of the 9 TPA smoke training locations and bald eagle sightings and concentration areas. Figure 37 presents the spatial relationship of bald eagle sightings and concentration areas to TPA smoke pot training locations in mobile fog oil training locations. Table 36 presents distances between bald eagle perching habitat and smoke pot training locations. We assessed effects to juvenile bald eagles and assumed their exposure points would be the same as adults. Effects to bald eagle eggs and hatchlings were assessed for each of the three nest locations.

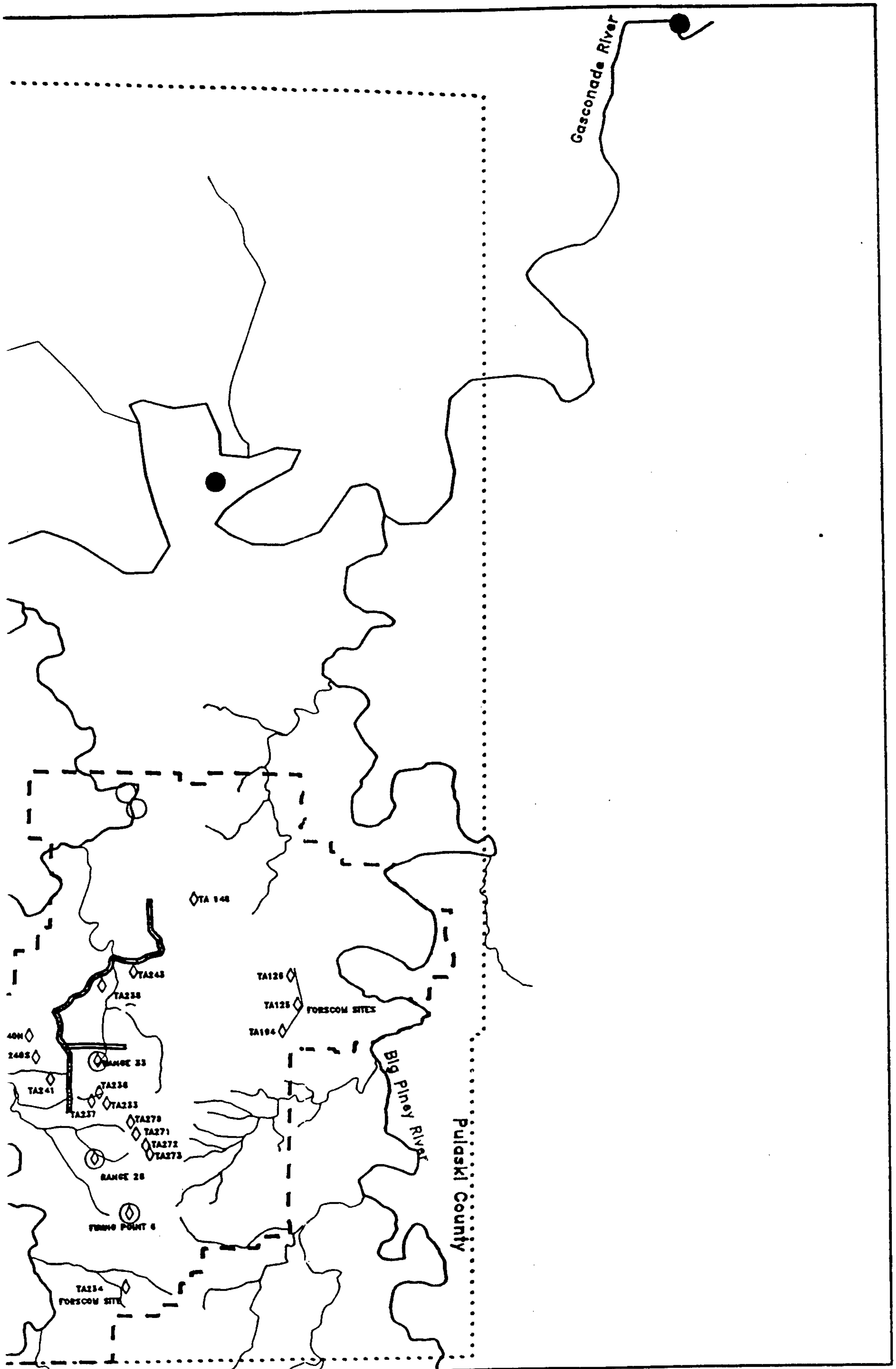
Summer nesting bald eagles will not be affected by inhaling unsafe concentrations of TPA from smoke pots. All 3 bald eagle nests are greater than 3000 m from the installation boundary. No unsafe concentrations of TPA from smoke pots will reach nests (Figure 42). Bald eagle eggs and hatchlings will not be affected.

TABLE 36. Distances between smoke pot use locations and bald eagle perching / foraging habitat along the Roubidoux Creek and Big Piney River. Distances to smoke pot use areas outside mobile smoke areas are measured to a central point within the use area.

Smoke Pot Use Location	Roubidoux Creek	Big Piney River
Cannon Range (Mush Paddle Hollow)	593	12,685
Bailey/McCann Hollow	823	8868
Musgrave Hollow	2569	7663
Ballard Hollow	3315	7783
FP 6	3085	8523
Range 28	2643	9761
Range 33	4281	9427
Ballard - In	3777	7924
Ballard - Out	3916	8320


N
Gasconade River
Roubidoux Creek
TA 146
TA243
TA235
TA126
TA125
TA194
TA240N
TA240S
RANGE 33
TA241
TA236
TA233
TA237
TA270
TA271
TA272
TA273
RANGE 28
SAPPER TA
FIRING POINT 4
TA234
FORSCOM SITE

1



APPEND

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FIGURE 42. Bal
smoke pot and smc
locations at Fort Le

- Bald Eagle N
- Smoke Grenc
- Smoke Pot U
- Smoke Grenc
- Fort Leonard
- County Boun
- River / Strec

Kilo
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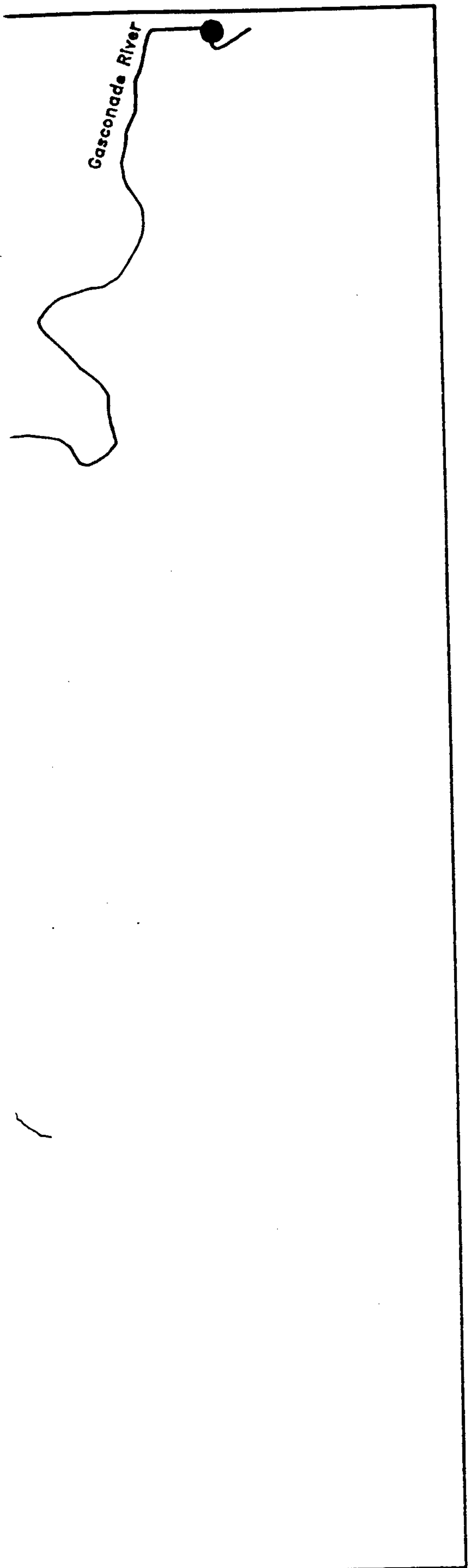

APPENDIX IV TO

BIOLOGICAL ASSESSMENT:

RELOCATION OF U.S. ARMY CHEMICAL SCHOOL AND MILITARY POLICE SCHOOL TO FORT LEONARD WOOD, MISSOURI

FIGURE 42. Bald eagle nests and smoke pot and smoke grenade training locations at Fort Leonard Wood, Missouri.

● Bald Eagle Nest

◊ Smoke Grenade Use Area

○ Smoke Pot Use Area

Smoke Grenade Training Road

Fort Leonard Wood Boundary

County Boundary

River / Stream

Kilometers

0 5 10

3D/ENVIRONMENTAL

Bald eagles will inhale unsafe concentrations of TPA released from smoke pots on Fort Leonard Wood.

- Wintering adult and juvenile bald eagles traveling, foraging, or perching within 3000 m of any of the 9 TPA smoke pot training locations will inhale unsafe concentrations of TPA smoke and exhibit acute toxicological effects (Table 37).

- No chronic toxicological effects are expected for bald eagles from TPA smoke pot training.

9.4 RISKS OF EXPOSURE TO M82 - TITANIUM DIOXIDE

Ingestion and dermal absorption pathways were determined to be incomplete for all three receptors. We analyzed inhalation effects of titanium dioxide released from M82 grenades. Based on our analysis, no effects are expected for Indiana bats, gray bats, or bald eagles from titanium dioxide grenades.

TABLE 37. TPA smoke pot training locations within 3000 m of bald eagle perching/foraging habitat. Chronic and acute inhalation effects from TPA smoke pots extend 3000 m from the source.

Smoke Pot Use Location	Roubidoux Creek
Cannon Range (Mush Paddle Hollow)	yes
Bailey/McCann Hollow	yes
Musgrave Hollow	yes
Range 28	yes

Section 10
Studies of Fog Oil Conducted for the BRAC Action

Section X:

Studies of Fog Oil Conducted for the BRAC Action

10.1 BACKGROUND

Smoke training with fog oil is a major training activity performed by the Chemical School at Fort McClellan. The movement of the Chemical School to Fort Leonard Wood will require this training to be continued at Fort Leonard Wood. Because the BRAC action may affect the human environment, an Environmental Impact Statement (EIS) was prepared. The studies summarized in this section were conducted to provide additional information for impact analysis in the EIS, Biological Assessment (BA), and two Ecological Risk Assessments.

Fog oil is a mineral oil resulting from the distillation of petroleum. It is a complex petroleum product that is heated to vaporization to produce smoke for obscurant training. Predicted fog oil use at Fort Leonard Wood and chemical characterization of fog oil can be found in Section V of this ERA. A toxicity profile of fog oil is presented in Section VII.

New fog oil is similar to old fog oil, but undergoes important chemical treatments modify its composition. The precise composition of fog oil is not well characterized. Although the compounds in fog oil have been identified, little data exist describing the isomers of the components and their percent composition. Fog oil has been used by the military for years. Fog oil obscured aircraft carriers and personnel in World War II. The military determined certain components of (old) fog oil may be hazardous to humans and the environment. The military now requires manufacturers to hydrotreat (new) fog oil. Hydrotreating removes the

compounds in fog oil called aromatics. Many aromatics are known or suspected human carcinogens. Old fog oil refers to fog oil manufactured before 1986 that has not been hydrotreated. New fog oil is hydrotreated, and has been manufactured since 1986.

Fog oil has had several designations in its history which may lead to confusion. There are two types of fog oil, "old" fog oil and "new" fog oil. Fog oil also has letter designations used by the military for purchasing or issuing requests for production from manufacturers. Types A and B are "old" fog oil (also referred to as SGF 1) manufactured under specifications A and B before 1986. "New" fog oil, designated as type D, is also referred to as SGF 2 fog oil (Standard Grade Fuel 2). It is the primary material used by the military to produce smoke at Fort McClellan and other installations. Fog oil type D or E will be used at Fort Leonard Wood. Fog oil types C, D, and E are chemically and structurally the same compounds. The designations refer to differing specifications given to manufacturers. The military requires that manufacturers perform carcinogenicity or mutagenicity tests on fog oil type D and E.

The (1) fugacity or environmental fate and transport of fog oil smoke, and (2) the composition of fog oil smoke relative to parent fog oil was poorly understood. Most information that exists was generated in tests only involving old fog oil. Very few studies have addressed fog oil smoke and the effects for the smoke itself. Environmental fate studies have not been conducted on new fog oil. The following studies were performed to provide information regarding these two issues.

10.2 ENVIRONMENTAL FATE OF FOG OIL AT FORT McCLELLAN, ALABAMA. AUGUST, 1996. PREPARED BY 3D/INTERNATIONAL INC., ENVIRONMENTAL GROUP.

10.2.1 Introduction

This study assessed the environmental fate of fog oil in areas where fog oil smoke production had occurred for an extensive amount of time (over 10 years). We statistically evaluated the presence of fog oil and its constituents at 3 exposure sites and a reference site. Fog oil has been used in large quantities (greater than 100,000 gallons per year) for several years at Fort McClellan. We were unable to precisely quantify the quantity used in the 3 exposure sites. Both old and new fog oil have been used in these areas. Only new fog oil was deployed since 1986.

We analyzed fog oil smoke samples from the types of fog oil generators to be used at Fort Leonard Wood. A description of M56 and M157 generators is included in Section V of this ERA. Samples were evaluated to assess chemical transformations, reactions, and decomposition products of fog oil the generators may produce. Several toxicological studies indicate fog oil heated to 500°C on a metal manifold, does not change significantly from the parent fog oil. However, these studies are not conclusive because they do not aerosolize fog oil as do M56 or M157 generators.

10.2.2 Methods

Three exposure sites (Range 24A, Range 56, and Battle Drill Area) and one reference site (Choccolocca Creek) were selected for this study. All samples were collected by employing EPA methods or other standard techniques. Method numbers, standard practices, and laboratory analytical methods are specified in the report.

Soil, surface water, and sediments were sampled from each site. Nineteen soil samples were taken at 3 depths to determine if fog oil components migrate into the soil at detectable concentrations. Samples were taken at 50 m upwind from fog oil release points and at 50 m, 100 m, and 200 m downwind from the release points. Soil sample depths were 3 inches, 1 foot, and 3 feet deep. Surface water and sediment samples were collected at the same location. Ten surface water samples and 10 sediment samples were collected at Range 56, Battle Drill Area, and Choccolocca Creek reference site. Five samples were collected upstream from the fog oil release point at 50 m intervals and 5 samples were collected downstream at 50 m interval locations. The stream at Range 24A was intermittent and samples were taken at 3 locations in 2 different streams near the release area.

Vegetation, insects, fish, and bats were collected from each sample site and analyzed for fog oil components. Three bark and leaf samples were collected from each sample site. Bark and leaf samples at exposure sites were collected as near to the smoke release point as possible. Thirty-five insect samples were collected at each sample site. Insect samples were composited due to the large amount of sample required for analysis. Twelve insect samples from each sample site were analyzed. Thirteen fish from Range 56, Battle Drill Area, and the Choccolocca Creek reference sites were collected and analyzed. No fish could be collected

from the very small stream at Range 24A. Twenty bats were collected from the sample sites. Eight guano samples were taken from gray bats caught during mist -netting.

Additional vegetation and insect sampling was performed at each sample site. Sampling events were paired to reduce variability between sample times when bats and insects were sampled at reference and exposure sites. Insect and bat presence on any night is substantially influenced by weather conditions and other factors unrelated to the presence of contaminants. Insect samples and additional vegetation samples were analyzed to determine if the reference site and the exposure sites were similar in composition and richness.

Fog oil smoke samples were collected from M56 and M157 smoke generators. One background sample was taken before the generators were turned on. Several smoke samples were taken at the generator and at 10 m, 20 m, and 30 m from the generators.

10.2.3 Results and Discussion

Samples collected at Fort McClellan were analyzed for aromatic hydrocarbons, and quantified for quinoline, methyl quinoline, biphenlys, 6 isomers of naphthalene, hexadecane, fluorene, dimethylbiphenyl, methyl fluorene, phenanthrene, anthracene, methylanthracene, methylanthracene, dimethylphenanthrene, ethylanthracene, and hexchloroethane. Samples indicating aromatic compounds were present were further tested to identify the possible compound. Analysis was completed utilizing Gas Chromatography/Mass Spec. Detection (GC/MSD) and Gas Chromatography/Flame Ionization Detection (GC/FID).

Most samples collected at exposure sites were not statistically different from those collected at the reference site. Most of the reference site samples had higher concentrations of hydrocarbons when compared to similar samples from exposure sites.

Bat tissue from two exposure sites had slightly higher concentrations of certain hydrocarbons. Concentrations of six hydrocarbons in bat tissue were significantly (statistically) higher at Range 56 than concentrations at the reference site ($p<0.10$). Concentrations of six hydrocarbons in bat tissue were significantly (statistically) higher at the Battle Drill Area than concentrations at the reference site ($p<0.01$). The concentrations of hydrocarbons in bat tissue samples are very small and near the detection limit for each compound. It is likely the 6 hydrocarbons in the samples are biological in origin, rather than from fog oil. No other

concentrations of hydrocarbons were statistically different at exposure and reference sites. None of the hydrocarbons analyzed for this study were found in the fog oil samples or the fog oil smoke samples.

In another phase of this study, we compared fog oil smoke samples to parent fog oil. Based on the analysis for the smoke samples, no aromatic compounds were identified. Approximately 99.2% of the smoke was the same hydrocarbons identified in the fog oil sample. There was a slight shift in lower molecular weight alkanes in the fog oil sample compared to the smoke samples. It appears there is some volatilization of the lower molecular weight hydrocarbons in fog oil when it is aerosolized to form smoke. Presumably, the volatilization results in the formation of carbon dioxide. This is supported by the lack of non-common hydrocarbons in the fog oil and smoke samples.

10.3 EVALUATION OF HUMAN HEALTH RISKS ASSOCIATED WITH FOG OIL TRAINING AT FORT LEONARD WOOD, MISSOURI. PRELIMINARY RISK EVALUATION REPORT. SEPTEMBER 1996. PREPARED BY HARLAND BARTHOLOMEW & ASSOCIATES, INC.

10.3.1 Introduction

This study was conducted to determine potential health risks to soldiers from occupational exposure to fog oil smoke. Field generated smoke samples were analyzed to determine the chemical composition of fog oil smoke. Specific chemicals listed on the EPA's Target Analyte List (volatile and semi-volatile organic compounds) were carried through a screening risk assessment. This Preliminary Risk Evaluation (PRE) was based on EPA Region IX guidance to determine if a hazardous waste site is, or has the potential to, affect the human population in the area. Region IX guidance is also used to rank hazards at sites and determine which chemicals pose the greatest risk. A carcinogenic risk and noncarcinogenic hazard quotient were calculated for each chemical. Chemical concentrations measured in the samples were compared to EPA's Region IX screening level concentrations to see if the fog oil smoke posed potential risks. Intake parameters were based on occupational exposure for the calculations.

A thorough literature review was conducted to determine what information was currently available and what human health effects have been identified for new and old fog oil. The chemical composition of new fog oil is poorly documented.

10.3.2 Methods

Field testing was conducted at U.S. Army Aberdeen Proving Ground, Edgewood, Maryland. Two smoke clouds were tested, one from the M56 generator and the second from a M157 generator. Samples were taken at various distances from the generators (Table 38).

Samples were collected with Summa 6 liter canisters and XAD-2 tubes. Samples were analyzed for VOCs (volatile organic hydrocarbons), SVOCs (semi-volatile organic hydrocarbons), and THC (total hydrocarbons). The report describes laboratory analysis methods.

10.3.3 Results and Discussion

Many compounds were found in the fog oil samples. The specific identification and quantification was not complete, but the overall composition was determined to be less than 2.5% VOCs and SVOCs. Because of the formation of so many isomers and non-TAL compounds, the exact formulation and quantity of many of the compounds were not precisely ascertained in the analysis. The PRE groups compounds based on their structural similarity and toxicity.

TABLE 38. Sample locations and sample types taken at Aberdeen.

Test 1 - M56 Generator	Test 2 - M157 Generator
2 Reference (Background)	2 Reference (Background)
11 meters	< 1 meter
11 meters	< 1 meter
25 meters	11 meters
25 meters	11 meters
200 meters	100 meters
200 meters	100 meters
Liquid SGF - 2 Fog Oil	Liquid SGF - 2 Fog Oil
Field (Trip) Blank	Laboratory (Method) Blank

The majority of the VOCs and SVOCs in the smoke samples are also commonly found in diesel and gasoline combustion products. It is assumed the small concentrations found in the fog oil samples resulted from the generator fuel source rather than from the fog oil.

The PRE determined the distance from M56 and M157 generators where respiratory protection is needed. Respiratory protection is required where ACGIH (American Conference of Industrial Hygienist) TLV - TWA (Threshold Limit Values) (Time Weighted Average) occupational levels are exceeded.

Section 11
Assumptions and Uncertainty Analysis

Section XI:

Assumptions and Uncertainty Analysis

11.1 ASSUMPTIONS

11.1.1 Chemical Stressors

The following assumptions were made with respect to fog oil, terephthalic acid, titanium dioxide, and other potential chemical stressors at Fort Leonard Wood:

1. receptor exposure to stressors was worst-case (i.e., maximum potentially available stressor quantity)

2. annual quantity of fog oil consumed by static smoke training is 8500 gallons per year

3. static fog oil smoke training would use a maximum quantity of 1200 gallons per day

4. annual quantity of fog oil consumed by mobile smoke training is 76,000 gallons per year

5. mobile fog oil smoke training would use a maximum quantity of 1200 gallons per day

6. daily exposure time equals the daily fog oil consumption rate (gallons/day) divided by the generator output rate of 0.66 gallons/minute-generator times the number of generators

7. the number of fog oil training events per year (i.e., exposure frequency) equals the annual consumption of fog oil (gallons/year) divided by the maximum daily use quantity (gallons/day)

8. only static <u>or</u> mobile fog oil smoke training occur on a given day

9. annual consumption of M82 smoke grenades (which contain titanium dioxide) is 48

10. maximum daily use of M82 smoke grenades is 72 with a maximum of 24 per location per day

11. M83 smoke grenades (which contain TPA) replace and will have the same annual consumption as G963, G930, AN-M9, and M8

12. total annual consumption of M83 grenades is 3136 grenades per year, maximum number to be released from 1 November through 15 March is 2242

13. maximum daily use of M83 grenades is 141 with a maximum daily use per location of 24

14. annual consumption of M8 smoke pots (which contain TPA) is 950

15. maximum daily use of M8 smoke pots is 59 with a maximum daily use per location of 24

16. burn time on M83, M8 smoke pot, and M82 is 2.5 minutes

17. deployment of each M83, M8 smoke pot, or M82 was considered an exposure event

18. the concentration of the simulants remained constant during release periods

19. the release rate of BIDS was 1 L per minute

20. annual use of PCAS is 1800 L

21. each PCAS training event uses 9 L (200 training events/year)

22. the Chemical/Biological Training Simulant and Delivery System (CBTSADS) sprays PCAS at least 10 m high.

23. Anisole, Benzaldehyde, Cyclohexane, Diethyl Malonate (DEM), and Diethyl Phthalate are used in the FOX training simulator (indoors) and will, therefore, not contact receptors

24. Dimethyl phthalate, Ethyl phthalate, Eucalyptol, and Methyl Salicylate are used outdoors, but simulants are contained within a pan of sand which is removed and decontaminated following a 2 hour training event

25. PEG 200 will be used at hasty decontamination sites only and will be sprayed approximately 5 m into the air

26. PEG 200 will not be sprayed onto vegetation or used within bat management zones

27. modeled concentrations of stressors represent realistic potential exposures

28. no site-specific differences in stressor concentrations (e.g., M82 smoke grenades assumed to have same dispersion at all training locations)

29. seasonal cave airflow model is representative of entire year

11.1.2 Receptors

Behavior and ecology of receptors affect their likelihood, duration, and frequency of exposure to stressors. The following assumptions were made with respect to bald eagles, Indiana bats, and gray bats (receptors):

1. bald eagles may be exposed to stressors at nest locations for 7 months

2. bald eagles do not forage on Fort Leonard Wood during summer months

3. bald eagles are resident at Fort Leonard Wood for 5 months during winter

4. bald eagles may travel anywhere on the installation during winter and perch/forage along the Big Piney River and Roubidoux Creek

5. when calculating bald eagle exposure to stressors by the ingestion pathway, we assumed bald eagles consumed only waterfowl (scaup) because this would provide the greatest dose of fog oil to the bald eagles

6. bald eagles live for 35 years

7. foraging or summer roosting Indiana bats can occur anywhere on the installation

8. summer Indiana bats may be exposed to stressors at anytime within a 24 hour period

9. Indiana bat summer season is 6 months

10. hibernating Indiana bats are exposed to stressors only at cave locations and may be exposed anytime in a 24 hour period

11. Indiana bat hibernation period is 8 months

12. Indiana bats live for 7 years

13. gray bats are only present on the installation for 7 months during summer

14. gray bats in caves may be exposed to stressors anytime in a 24 hour period

15. foraging gray bats will be exposed to M83 grenades, M82 grenades, or M8 smoke pots only at night (we assumed one half of annual consumption of these munitions could be used at night)

16. when calculating Indiana bat and gray bat exposure to stressors by the ingestion pathway, we assumed both bat species consumed only beetles with a surface area of 0.000033 m^2 and a weight of 0.0034 g

17. gray bats live for 10 years

18. for bald eagles, Indiana bats, and gray bats, we calculated dermal absorption assuming complete coverage of the organism and 100% absorption

19. number of exposure points was appropriate and no exposure points were missed

20. identified exposure pathways were complete and no pathways were missed

21. allometric equations used to calculate intake rates accurately represent intake rates of receptors

22. the same individual receptors were exposed year after year (i.e., chronic effects are to an individual exposed for its lifetime)

11.1.3 Toxicity Values

Toxicity values are determined from available studies and are rarely available for receptor species of interest. In the absence of species specific information, available data is generally applied to receptors with the use of uncertainty adjustments. The following assumptions were made with respect to toxicity values:

1. Toxicity Reference Values (TRVs) are unbiased and representative for bald eagles, Indiana bats, and gray bats

2. bald eagles, Indiana bats, and gray bats will have the same effects for TRVs as reported in critical studies

3. stressors of concern have same pharmacokinetic effects in receptor species as in test species from which toxicity value was derived

4. TRVs represent conservative threshold values and are protective of threatened and endangered species

5. an exposure concentration greater than a TRV is unsafe, while an exposure concentration less than a TRV is safe

6. the calculated NOAEL (from BATS.XLS) is accurate, unbiased, and representative for bald eagles, Indiana bats, and gray bats

7. uncertainty factors applied to toxicity values are appropriate

8. extrapolation of toxicity values from species to species is appropriate

9. no synergistic, additive, or antagonistic effects of stressors

10. acute and chronic toxicity values selected to derive TRVs were appropriate for all receptors

11.1.4 Risk Characterization

Risk characterization is a process of integrating exposure and effect relationships, and relating effects to receptor populations. A fundamental tool of risk characterization is the Hazard Quotient (HQ). We made the following assumptions regarding Hazard Quotients:

1. HQs are reliable and unbiased estimators of risk or unacceptable exposure

2. risks associated with HQs greater than 1 were considered significant impacts, but magnitudes of risks or impacts were not determined

11.2 UNCERTAINTY ANALYSIS AND DISCUSSION

All risk assessment include uncertainties. As part of estimating risks, uncertainties result, especially in predictive risk assessments. It is important to limit the number of uncertainties where possible, by basing the assessment on realistic, accurate, site-specific data. Most risk assessments involve the use of assumptions. These assumptions, based on best professional judgment, increase the degree of uncertainty of the risk assessment. Uncertainty can also result from:

- imperfect knowledge of ecosystem function and the ecological role of receptors
- failure to identify and temporally or spatially interrelate exposure
- incorrectly defining ecological effects to receptors from stressors
- inaccurately addressing, recognizing, or characterizing secondary (indirect) effects
- inadequately characterizing stressors
- the selection of inappropriate estimators of risks.

This ERA is predictive and was conducted to estimate risks from the purposed BRAC Action. Because it is predictive and the BRAC Action has not occurred, risks described within this document are based on assumptions, estimations, assertions, and predictions. The ERA supports the Environmental Impact Statement and Biological Assessment for the BRAC action at Fort Leonard Wood. Risks were determined for certain chemical stressors that will be

introduced as a result of the action. This ERA provides information about the potential for chemical stressors to affect receptors. It estimates the number of individuals that may be affected. Although it includes assumptions and other uncertainties, the ERA is a valuable predictive tool for decision makers.

Section 11.1 of this ERA presents assumptions made regarding stressors, receptors, toxicity values, and risk characterization. The following section describes uncertainty in the analysis resulting from use of these assumptions.

11.2.1 Stressors

The stressors evaluated for this ERA are obscurants (fog oil and terephthalic acid), simulants (biological and chemical), and non-specific simulants. Because these chemicals have not been used at Fort Leonard Wood, we could not collect empirical field data regarding their dispersion.

In the absence of comprehensive site-specific empirical data, we employed modeling in this analysis. We used the best technology available at reasonable cost to model stressor dispersion and concentration under various atmospheric stability categories. Modeling introduces uncertainty. Models used in this ERA are currently used by the military for their training. The air dispersion model (TREMS1) used in this assessment was developed by the military especially for obscurants. The dispersion of obscurants is affected by terrain and atmospheric conditions. It is not possible to predict the precise combinations of terrain and atmospheric conditions that will be present when obscurants are deployed. We modeled stressor dispersion under a variety of atmospheric stabilities and average terrain conditions. Assuming average terrain conditions may cause imprecise predictions of stressor concentrations at exposure points. The models also have other limitations that may affect their output. The TREMS1 air dispersion model is does not accurately predict stressor concentrations at distances less than 50 - 100 meters from the source. Exposure and resulting risk we predicted in these small areas may not be accurate.

The quantity, release mechanism, precise location, and number of stressor deployment events per year was estimated. Estimates are based upon the best available information. When definitive information was unavailable concerning the amount of stressor to be deployed

per unit time (or area), we based calculations upon the maximum amount of stressor (or least distant deployment site) expected. This approach, although appropriate when information was unavailable, is conservative and probably overestimates risks.

Certain stressors were eliminated from detailed analysis in this ERA because the screening risk assessment showed they would not affect receptors. The *screening risk assessment* was conducted using worst case scenarios for each stressor. Risks assessed in the *screening risk assessment* were intentionally overestimated to avoid erroneously eliminating stressors from detailed analysis. Exposure pathways for several chemicals in the screening risk assessment were incomplete. Additional analysis of these chemicals was not warranted. If the exposure pathways actually exist, and if risks result, we may have inappropriately underestimated risks.

The fate and transport of stressors in the environment was given consideration in assessing effects. We collected empirical data assessing the fate, and residence time of fog oil only in our studies completed at Fort McClellan. If stressors remain in the environment longer than predicted, risks associated with these stressors may be underestimated in our assessment.

Stressors may be released simultaneously during multiple training events. We did not address effects from multiple and/or simultaneous stressor releases. Our characterization of risks to these receptors may not have been fully assessed. Risks from all stressors except fog oil, TPA, and titanium dioxide, were based on the maximum quantity to be used at any location for any training event. Fog oil, TPA (grenades and smoke pots), and titanium dioxide have many possible release locations and training scenarios. While we assumed the maximum daily limit would be released from any one training location, we did not assessed effects to receptors that may repeatedly receive the maximum daily amount from two or more locations. Effects to receptors utilizing areas between TPA and titanium dioxide grenade locations training are not underestimated because we assumed all the grenades were released from each available deployment site per year. We were unable to accurately estimate the number of training events and number of grenades that will be used at each of 22 available locations. Predicted exposure to TPA and titanium dioxide is likely overestimated. The effects of fog oil were assessed based on the predicted amount of fog oil to be used at training locations.

Receptors between (in overlap areas) training locations may receive higher doses than predicted in this ERA.

There are uncertainties in our assessment of effects of TPA smoke pots. Receptors may be exposed to TPA from smoke pots and fog oil at the same time during certain training activities. Smoke pots are currently used by the military to fill in gaps in incomplete fog oil smoke screens. The combined toxicity of fog oil and TPA may be different than the separate toxicity of each chemical. It is possible receptors may be more susceptible to acute or chronic toxicological effects from either chemical if they are simultaneously exposed to both. Additional studies are required to adequately characterize effects of exposure to multiple stressors.

Receptors may be exposed to more than one chemical stressor during their lifetime, but these exposures and resulting effects can not be predicted with a reasonable level of certainty. It is beyond the scope of this analysis to predict these effects. This analysis would require information not currently available, including the number and frequency of exposure to each stressor. Risks to certain receptors may be underestimated in this ERA.

11.2.2 Receptors

Assessment endpoints of this ERA are listed by the federal government as endangered or threatened. When precise, site-specific information describing the proposed action or receptors was not available, we conservatively developed estimates (i.e. we included estimates that assume the proposed action will occur in a manner most likely to affect the listed species). For example, we assumed stressors would be deployed during the seasons receptors are present (e.g. if fog oil was going to be released 70 days per year, we assumed the releases would occur during the 7 months when Indiana bats hibernate on the Installation. This approach, necessitated when important information was not available, may overestimate actual exposure.

We estimated the exposure of receptors, including those involved in activities typical for the species, and sensitive life cycle stages. The estimated the amount of time receptor perform activities exposing them to stressors. Our estimates were based on the upper bound percentile rather than the average. For example, gray bats forage primarily along stream

corridors from approximately dusk until dawn. Many of the gray bats do not start foraging until dark and others do not finish foraging until early morning. To account for exposure to gray bats with the longest foraging times, we assumed foraging time was 12 hours per day. We used a similar approach in estimating the time sensitive life stages would be exposed to stressors. Intake parameters reflect the largest exposure each species/life stage could reasonably be expected to encounter. For example, we considered the entire surface area of the bald eagle egg as an exposure point. Realistically, the egg is sheltered by the nest and may be exposed to stressor deposition on only its upper surface. We did not account for stressors being removed from the surface of eggs when they are turned in the nest by adult eagles.

Where appropriate information was lacking, we made certain assumptions that could be considered "worst case." We assumed all the food receptors consumed on days when an exposure event occurred was contaminated. The assumed all of the stressor deposited on receptor's skin was absorbed. We assumed stressor that was ingested or inhaled was absorbed, rather than passed through receptor's body. Based on best professional judgment, we selected typical food sources for each receptor that would have the greatest amount of stressor on them. For example, we assumed bald eagles ate scaup on the days when stressors were deployed. This is an aquatic waterfowl that has a larger surface area and more potential to encounter greater concentrations of the stressor than a fish. These types of assumptions add uncertainty to the risk assessment, yet they are unavoidable.

Our effects determinations also involve uncertainty. Although we evaluated direct effects quantitatively, indirect effects were evaluated qualitatively. The biomonitoring plan to be developed by the installation will detect changes in the ecosystem at Fort Leonard Wood after the BRAC action. This plan will incorporate monitoring of endangered and threatened species populations as well as some of their primary prey populations. While this does not reduce the uncertainty, it will assist in preventing indirect effects incompletely characterized in this ERA.

11.2.3 Toxicity Values

There are unavoidable uncertainties associated with the toxicity assessment in this ERA. Because specific toxicity values were not developed for stressors and receptors, we

developed Toxicity Reference Values (TRVs) for each receptor. The TRV may not adequately represent a safe toxicity value for every individual receptor or sensitive life cycle stage. We applied Uncertainty Factors (UFs) to each TRV to develop toxicity values. Without specific toxicity testing of each receptor, or at least most sensitive life stages of the receptors (e.g. pregnant or gravid females), we can not quantify the uncertainty involved with application of Uncertainty Factors.

The toxicity values upon which we based TRVs may not be representative of receptors in this ERA, and the critical effects described may not be accurate. It is not known how well, for example, a rat (test species) represents a bald eagle. The two species may have different pharmacokinetics or pharmacodynamics. The bald eagle may be better able to rid itself of the stressor than the rat.

Available toxicity values may not adequately address all receptor life cycle stages. For example, a toxicity value developed for a rat may not account for a reduction in respiration through the interstitial spaces of a bald eagle egg. We do not know if the test species adequately represent the stressor response model for Indiana bats or gray bats. This area of uncertainty is common in risk assessments, and is unavoidable until receptor-specific testing is completed. We believe our application of UFs appropriately addresses this source of uncertainty.

11.2.4 Exposure Assessment

Uncertainties in the exposure assessment resulted from the lack of specific information and exposure point concentrations. Most of the exposure point concentrations were modeled, and therefore include uncertainty. Our characterization of stressor deployment involves estimates and uncertainty. Where site-specific information describing the location of deployment sites was lacking, our estimates may overestimate acute and chronic risks.

Intake parameters for each receptor were developed so receptors would receive the greatest dose realistically possible, given the training conditions at Fort Leonard Wood. We evaluated effects to receptors for different activities. Release of stressors may occur at times other than those when receptors are on the installation or performing certain activities, leading to overestimation of risk in this ERA.

Exposure point concentrations in bat caves may not be accurate. We developed a specific air flow model for each cave that can be used to estimate the amount of time the chemical remains in the cave. The model may not correctly describe air flow inside the cave, or may not describe it accurately for all seasons.

11.2.5 Risk Characterization

The Risk Characterization step of any risk assessment involves uncertainties as it incorporates estimates and assumptions made in earlier assessment phases. The effect or risks were based on the ratio of intakes (calculated for each stressor and pathway) to toxicity values (assumed to be safe for the receptor). Risks for this ERA were based on Hazard Quotients (HQ) > 1. An HQ > 1 indicates the receptors are taking in more of the stressor than considered safe. The HQ is considered a point estimate. HQs only evaluate risks from one exposure concentration at a time. Chemical stressors not yet released would result in more than a single concentration. The HQs in this ERA were based on maximum exposure concentrations used in intake equations from the stressor source for receptors at stationary locations (e.g. hibernacula). HQs based on variable exposure points, where receptors have many possible locations, were determined at varying distances from the stressor source. HQs based on the maximum predicted exposure concentrations only reflect the risks to receptors for that concentration. They may overestimate the actual risk.

The HQ does not assist in estimating the number of receptors that may be at risk. Nor does it describe the effects that will occur when unsafe exposures occur.

Section 12
Literature Cited

Section XII:

Literature Cited

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Attachment A
Training Materials to be Used at Fort Leonard Wood

ATTACHMENT A:

Training Support Materials to be Used at Fort Leonard Wood

TABLE A-1. Training support materials to be used at Fort Leonard Wood as a result of the BRAC action. Materials were screened for potential risks to bald eagles, Indiana bats, and gray bats (receptors). Materials which could not be excluded were carried through a complete Ecological Risk Assessment (ERA).

Item	Estimated Annual Quantity	Interior/ Exterior Use	Reason for Exclusion Following Primary Screening[1]	Exclusion Following Screening ERA[2]	To be Examined in Future Studies[3]	Analyzed in ERA
Military Police Chemicals						
Ethyl 2-cyanoacrylate	200 ounces	exterior	C,D			
BIDS Simulants						
Bacillus subtillus var. Niger	23 kg	exterior	NA	Yes		
Male Specific Coliphage (MS2)	180 ml	interior	NA	Yes		
Erwinia herbicola	180 ml	interior	NA	Yes		
Ovalbumin	180 ml	interior	NA	Yes		
Kaolin Dust (KD)	11 kg	interior and exterior	NA	Yes		
FOX Simulants						
Anisole	30 ml	interior	NA	Yes		
Benzaldehyde	30 ml	interior	NA	Yes		

Item	Estimated Annual Quantity	Interior/ Exterior Use	Reason for Exclusion Following Primary Screening[1]	Exclusion Following Screening ERA[2]	To be Examined in Future Studies[3]	Analyzed in ERA
Cyclohexanone	30 ml	interior	NA	Yes		
Diethyl malonate (DEM)	4.03 L	interior	NA	Yes		
Diethyl phthalate	1.2 L	interior	NA	Yes		
Dimethyl phthalate	60 ml	interior	NA	Yes		
Ethyl phthalate	30 ml	interior	NA	Yes		
Eucalyptol	6 L	interior	NA	Yes		
Isopropyl	18 ounces	interior	NA	Yes		
Methyl salicylate (MES)	30 ml	interior	NA	Yes		
Soman (GD), Sodium carbonate, polyethylene oxide, hydroxy ethyl cellulose. glycerol, diethyl malonate	1,800 L	exterior	NA	Yes		
Mustard - Lewisite (HL), Ferrous ammonium sulfate, polyethylene oxide, hydroxy ethyl cellulose, glycerol, methyl salicylate	1,800 L	exterior	NA	Yes		
Chemical Agent Disclosure Solution (CADS), 2,,2 Dipyridyl, phenolphthalein & isopropanol	1,800 pints	exterior	NA	Yes		
Toxic Agents						
VX	300 ml	interior	C,D			
GB (Saran)	200 ml	interior	C,D			
DF	100 ml	interior	C,D			
QL	800 ml	interior	C,D			

Item	Estimated Annual Quantity	Interior/ Exterior Use	Reason for Exclusion Following Primary Screening[1]	Exclusion Following Screening ERA[2]	To be Examined in Future Studies[3]	Analyzed in ERA
Radioisotopes						
All Radioactive Sources	millicurie and microcurie	interior and exterior	B,C,D			
Munitions						
Charge demo, C4, 11/4 lb (MO23)	13,005 units	exterior	NA	NA	Yes	
Thickening Compound, M4 (K917)	21,200 ounces	exterior	NA	NA	Yes	
CS (tear gas)	3500 capsules	interior and exterior	NA	NA	Yes	
Grenade Hand CS (tear gas)	5530	interior and exterior	NA	NA	Yes	
Grenade Hand Smoke, green	3875	exterior	NA	NA	Yes	
Grenade Hand Smoke, yellow	2350	exterior	NA	NA	Yes	
Grenade Hand Smoke, red	930	exterior	NA	NA	Yes	
Grenade Hand Smoke, violet	840	exterior	NA	NA	Yes	
Grenade Hand Smoke, M82, titanium dioxide	864	exterior	NA	No		Yes
Grenade Hand, fragmentation M67	48,216	exterior	A,D			
Illuminated Projectile Grenade	85	exterior	D			
Obcurant, Fog Oil	85,000 gallons	exterior	NA	No		Yes
Signal Illumination, green para	35	exterior	NA	NA	Yes	
Signal Illumination, red para	650	exterior	NA	NA	Yes	
Signal Illumination WS cluster	6280	exterior	NA	NA	Yes	
Signal Illumination, WS green star	510	exterior	NA	NA	Yes	

Item	Estimated Annual Quantity	Interior/ Exterior Use	Reason for Exclusion Following Primary Screening[1]	Exclusion Following Screening ERA[2]	To be Examined in Future Studies[3]	Analyzed in ERA
Signal Illumination RS cluster and RS para	315	exterior	NA	NA	Yes	
Simulated Hand Grenade (M116)	3980	exterior	NA	Yes		
Simulated Projectile Air Burst (M9)	90 each	exterior	C,D			
Simulated Projectile Ground Burst	3660	exterior	C,D			
Simulated Artillery Gun Flash	15	exterior	C,D			
Grenade Hand Smoke, M83, TPA	5534	exterior	NA	No		Yes
Smokepot M8 TA, TPA	1115	exterior	NA	No		Yes
Expended Motor Gasoline.	18,450 gallons	exterior	NA	NA	Yes	
Miscellaneous						
Acetone	47 L	interior	C			
Alkali Powder	100 lbs	exterior	B,D			
Aluminum oxide	10 g	interior	C			
Ammonia	96 ounces	interior	C			
Buffer solutions	800 ml	interior	C			
C-2 Mask canisters	7250	interior	A			
Calcium hypochloride	20,000 lbs	interior	C,D			
Carbon disulfide	30 ml	interior	B,C			
Charcoal, activated	200 g	interior	B,C			
Chloroform	50 ml	interior	B,C			
Chromosorb 10G	50 g	interior	B,C			
Corrosion Inhibitor, active ingredient = Dicyclohexal ammonium nitrite	64 ounces	exterior	C,D			
Cyclohexane	10 ml	interior	B,C			

Item	Estimated Annual Quantity	Interior/ Exterior Use	Reason for Exclusion Following Primary Screening[1]	Exclusion Following Screening ERA[2]	To be Examined in Future Studies[3]	Analyzed in ERA
Dry Cleaning Solvent	3 bottles	interior	C			
DS-2	2670 gallons	interior	C			
Ethanol	1 L	interior	C			
FC-43, Fluorinert	10 ml	interior	B,C			
Gelbands	150 bands	interior	B,C			
Glass Wool	1 container	interior	C			
Hexane	100 ml	interior	B,C			
Hydro-chloric Acid	100 ml	interior	C,D			
Isopropyl Alcohol	240 pints	interior	C,D			
Isopropyl Amine	150 ml	interior	C,D			
M13 filters	1,500 sets	interior	C,D			
Megabore Test Mix	10 ml	interior	B,C,D			
Methanol	200 ml	interior	C,D			
Methyl chloride	50 ml	interior	B,C,D			
Mineral Oil	120 pints	interior	C,D			
n-Amyl-acetate	4.7 L	interior	C,D			
Nitric Acid	100 ml	interior	C,D			
PEG-200, mixed with Butyl mercaptan	50 gallons	exterior	D			
Potassium chloride solution	5 ml	interior	C,D			
Potassium dichromate	3 g	interior	C,D			
Potassium fluoride	60 g	interior	C,D			
Potassium iodide	100 g	interior	C,D			
Snoop Liquid Leak Detection	500 ml	interior	C,D			
Sodium bicarbonate	200 g	interior	C,D			
Sodium carbonate (soda ash)	200 lbs	interior	C,D			
Sodium hypochlorite	4,500 gallons	interior	C,D			
Sodium thiosulfate	50 grams	interior	C,D			

Item	Estimated Annual Quantity	Interior/ Exterior Use	Reason for Exclusion Following Primary Screening[1]	Exclusion Following Screening ERA[2]	To be Examined in Future Studies[3]	Analyzed in ERA
Microcare Solvent Cleaner (BENESOLVE), contains: Dichloro-fluroethane, methal ash, Oleoethane, and Tetrafluoro-ethane (HFC)	18 cans	interior	C,D			
Stannic Chloride Tubes	2460 tubes	interior	C,D			
Sulphur	120 g	interior	C,D			
Sulfuric Acid	100 ml	interior	C,D			
Talc Powder	200 g	interior	C,D			
Tenax	10 g	interior	C,D			
Sodium hydroxide	250 lbs	interior	C,D			

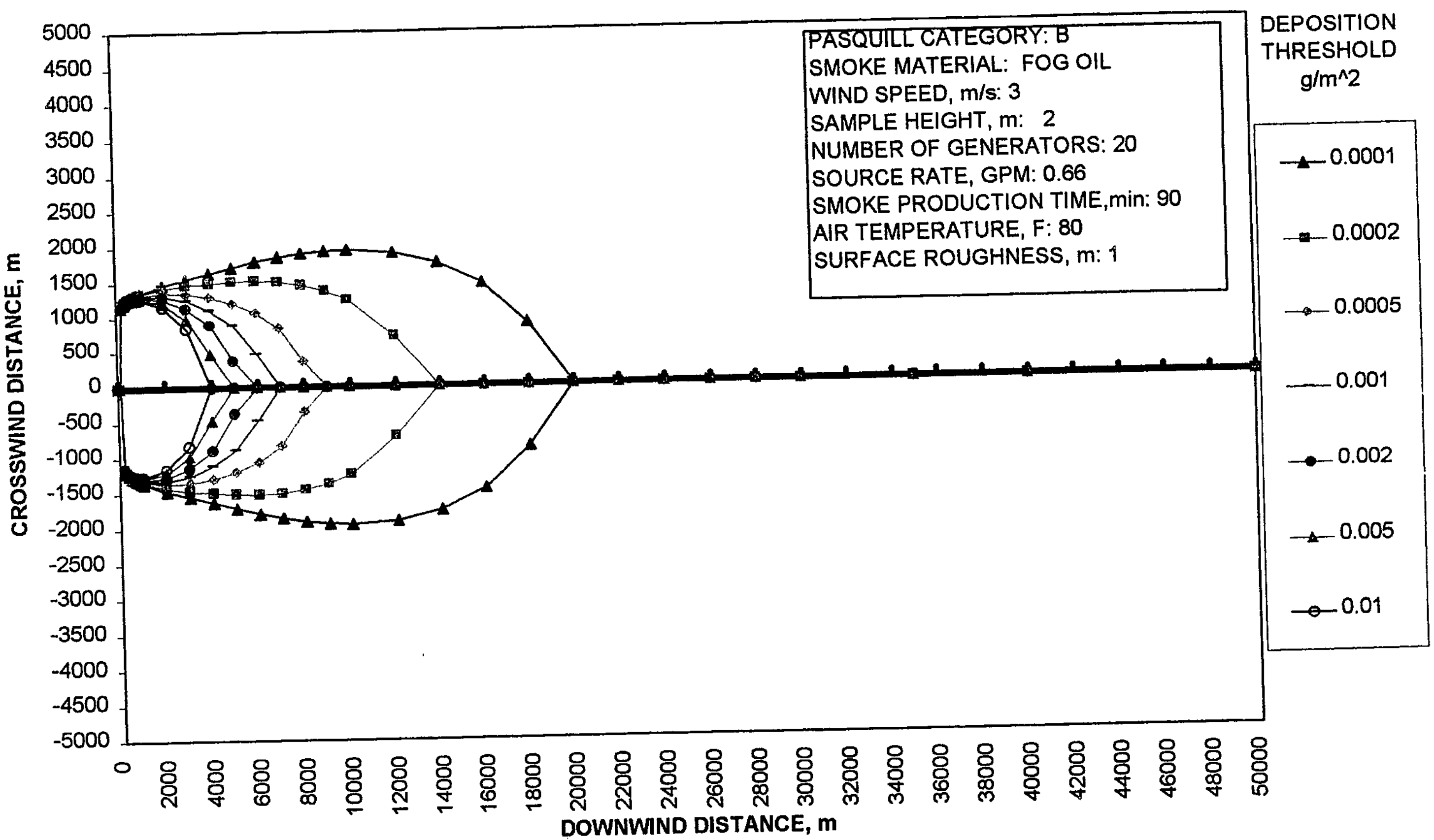
1. Primary screening analysis for training support materials included examination of the materials toxicity, quantity, location of use and storage (e.g., indoors only), and method of use or deployment (e.g., material contained). Letter designations that follow indicate reason for exclusion from further analysis:
   - A. material has no toxicity or low toxicity
   - B. quantity of material used is inadequate to pose potential risk
   - C. material storage and use locations minimize or eliminate contact with receptors
   - D. method of use or deployment does not pose potential risk to receptors

2. Materials examined in the Sreening Ecological Risk Assessment (ERA) were subject to broad-base assumptions with respect to material distribution, receptor exposure, and toxicity value. Only inhalation and ingestion exposure pathways were examined for the sreening ERA. Acute and chronic toxicity reference values (TRVs) were compared with estimated exposures. If estimated exposure concentration exceeded the TRV, the material was analyzed in the ERA.

3. Use of these materials will be episodic. Materials will be used at locations throughout the installation. Although exposure to substantial quantities of these materials may affect Indiana bats, gray bats, and bald eagles; proposed use of these materials is unlikely to adversely affect these species. A biomonitoring plan will be designed and implemented by Fort Leonard Wood to assess effects of these materials.

NA = Not Applicable

Attachment B
Deposition Isopleths for Fog Oil
(Pasquill Categories B, C, and D)



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DOWNWIND DISTANCE, m
PASQUILL CATEGORY: B
SMOKE MATERIAL: FOG OIL
WIND SPEED, m/s: 3
SAMPLE HEIGHT, m: 2
NUMBER OF GENERATORS: 20
SOURCE RATE, GPM: 0.66
SMOKE PRODUCTION TIME,min: 90
AIR TEMPERATURE, F: 80
SURFACE ROUGHNESS, m: 1
DEPOSITION THRESHOLD g/m^2
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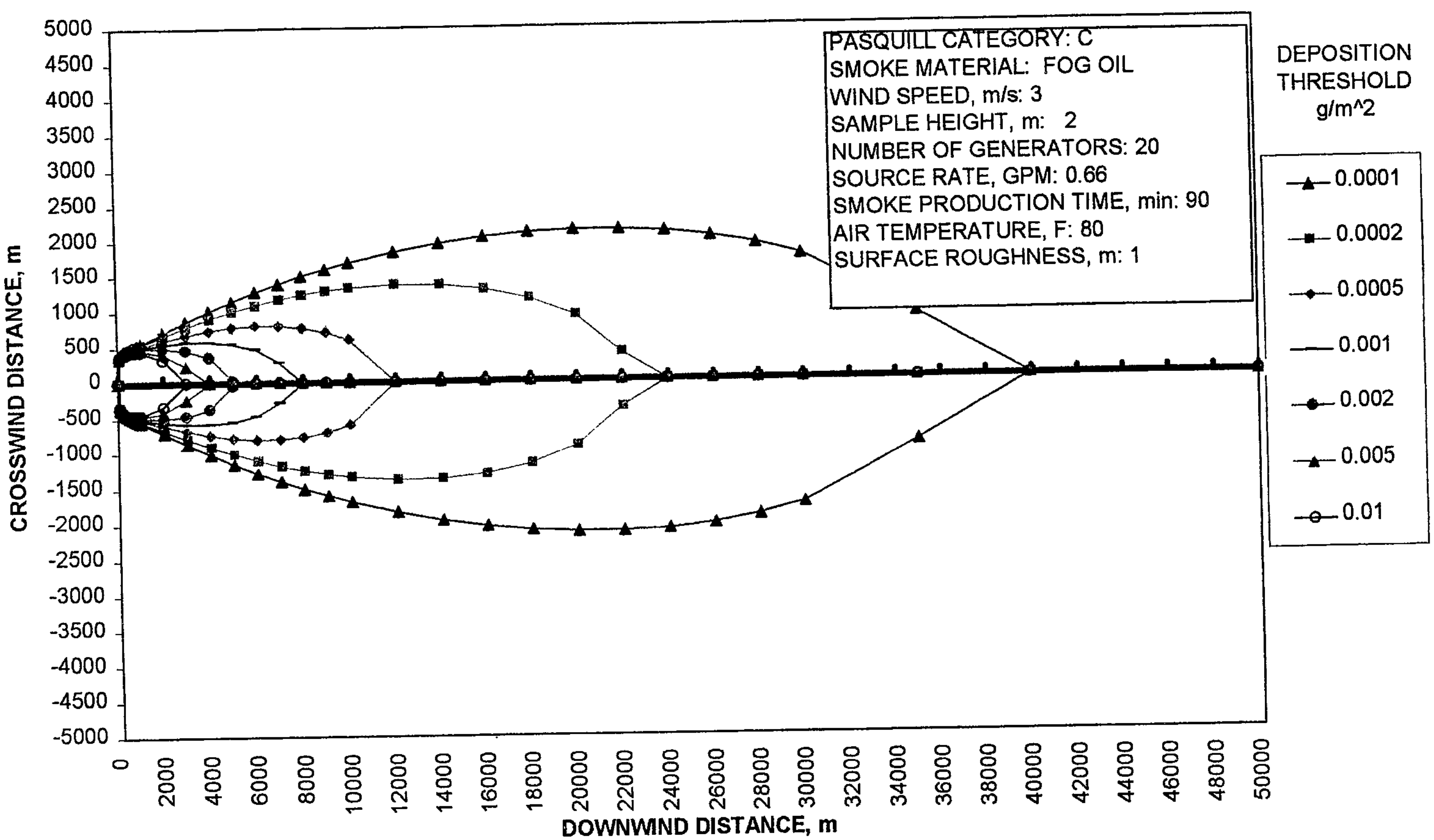
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DOWNWIND DISTANCE, m
PASQUILL CATEGORY: C
SMOKE MATERIAL: FOG OIL
WIND SPEED, m/s: 3
SAMPLE HEIGHT, m: 2
NUMBER OF GENERATORS: 20
SOURCE RATE, GPM: 0.66
SMOKE PRODUCTION TIME, min: 90
AIR TEMPERATURE, F: 80
SURFACE ROUGHNESS, m: 1
DEPOSITION THRESHOLD g/m^2
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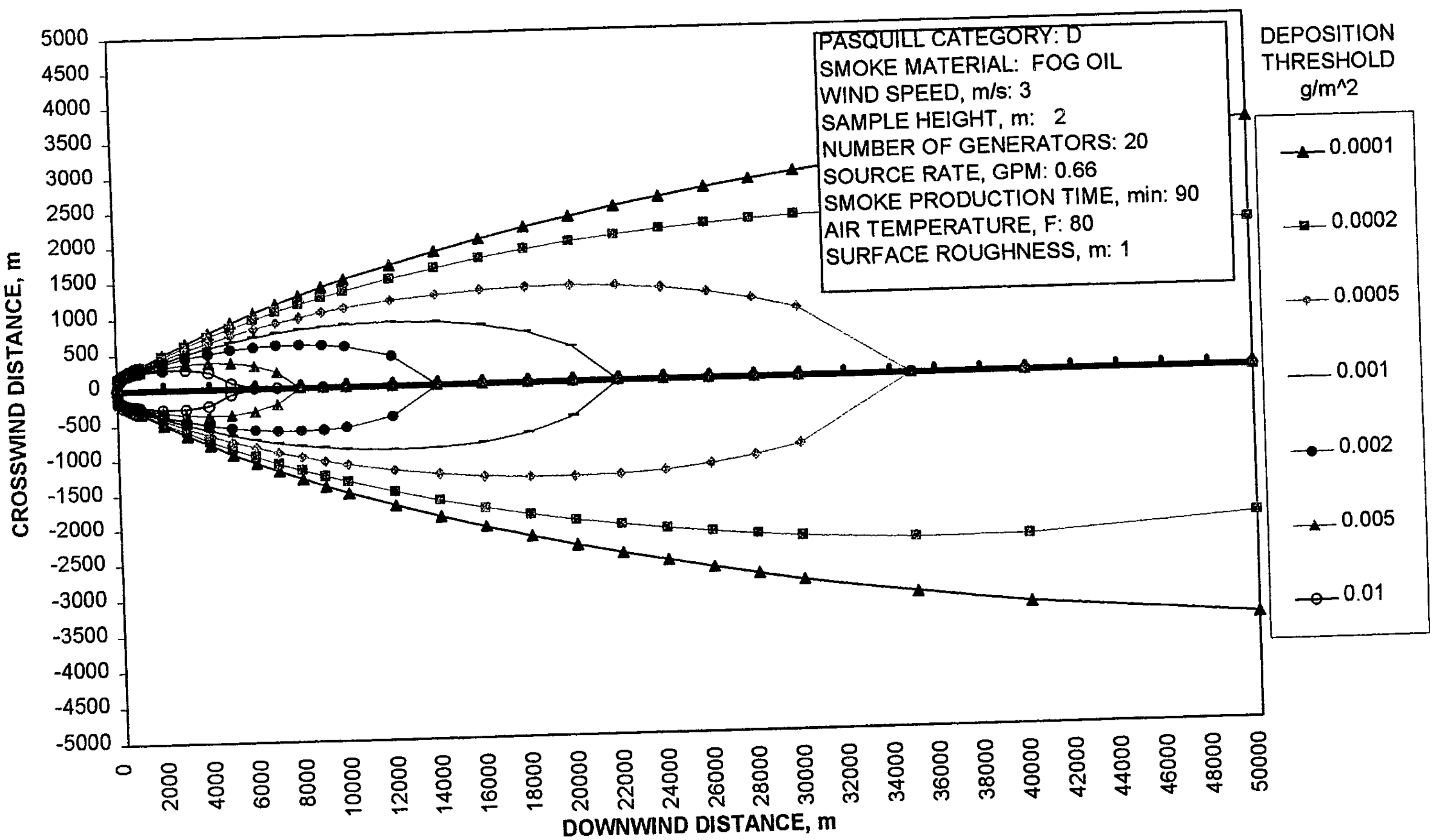
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WIND SPEED, m/s: 3
SAMPLE HEIGHT, m: 2
NUMBER OF GENERATORS: 20
SOURCE RATE, GPM: 0.66
SMOKE PRODUCTION TIME, min: 90
AIR TEMPERATURE, F: 80
SURFACE ROUGHNESS, m: 1
DEPOSITION THRESHOLD g/m^2
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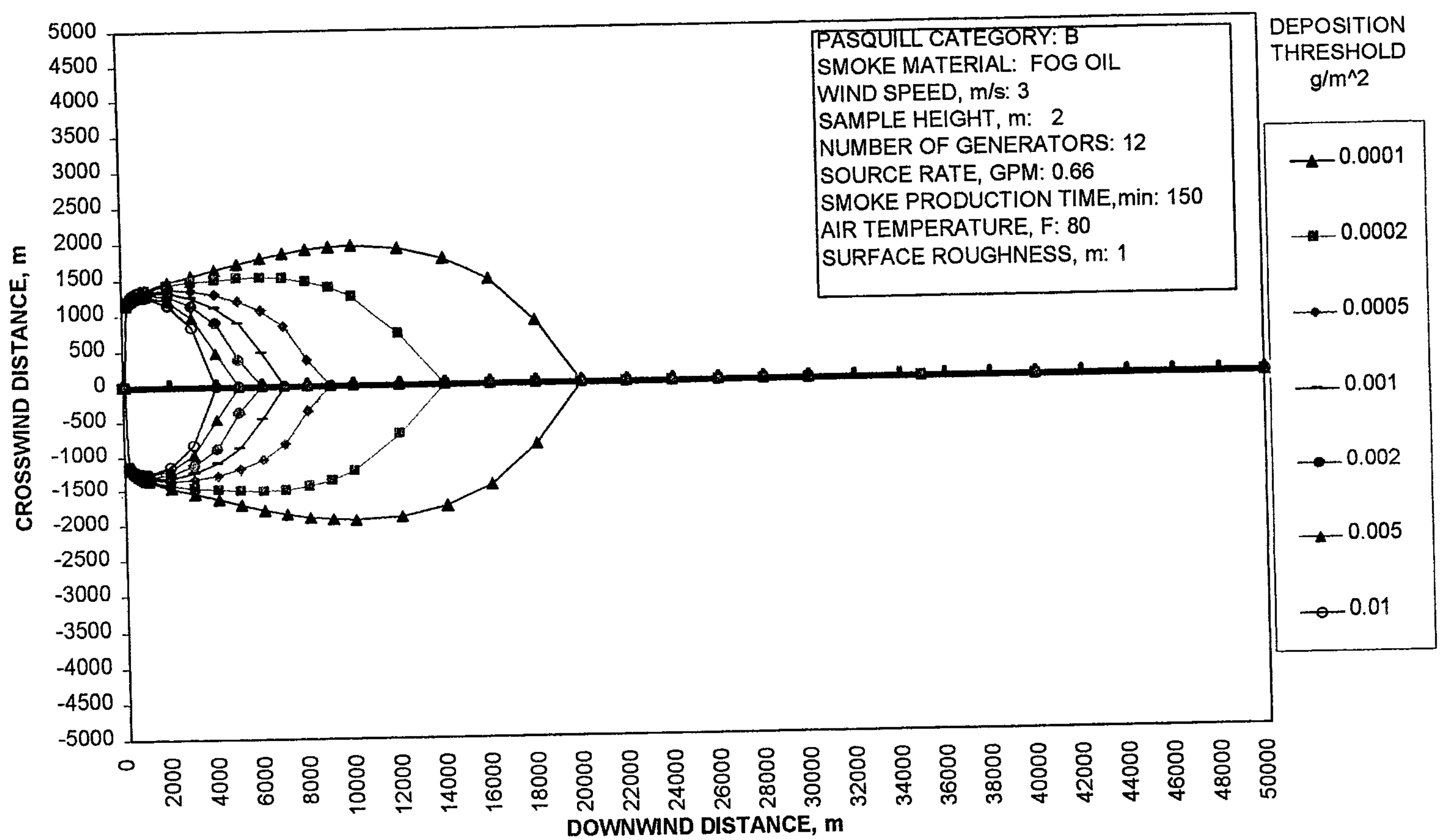
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SMOKE MATERIAL: FOG OIL
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SAMPLE HEIGHT, m: 2
NUMBER OF GENERATORS: 12
SOURCE RATE, GPM: 0.66
SMOKE PRODUCTION TIME,min: 150
AIR TEMPERATURE, F: 80
SURFACE ROUGHNESS, m: 1
DEPOSITION THRESHOLD g/m^2
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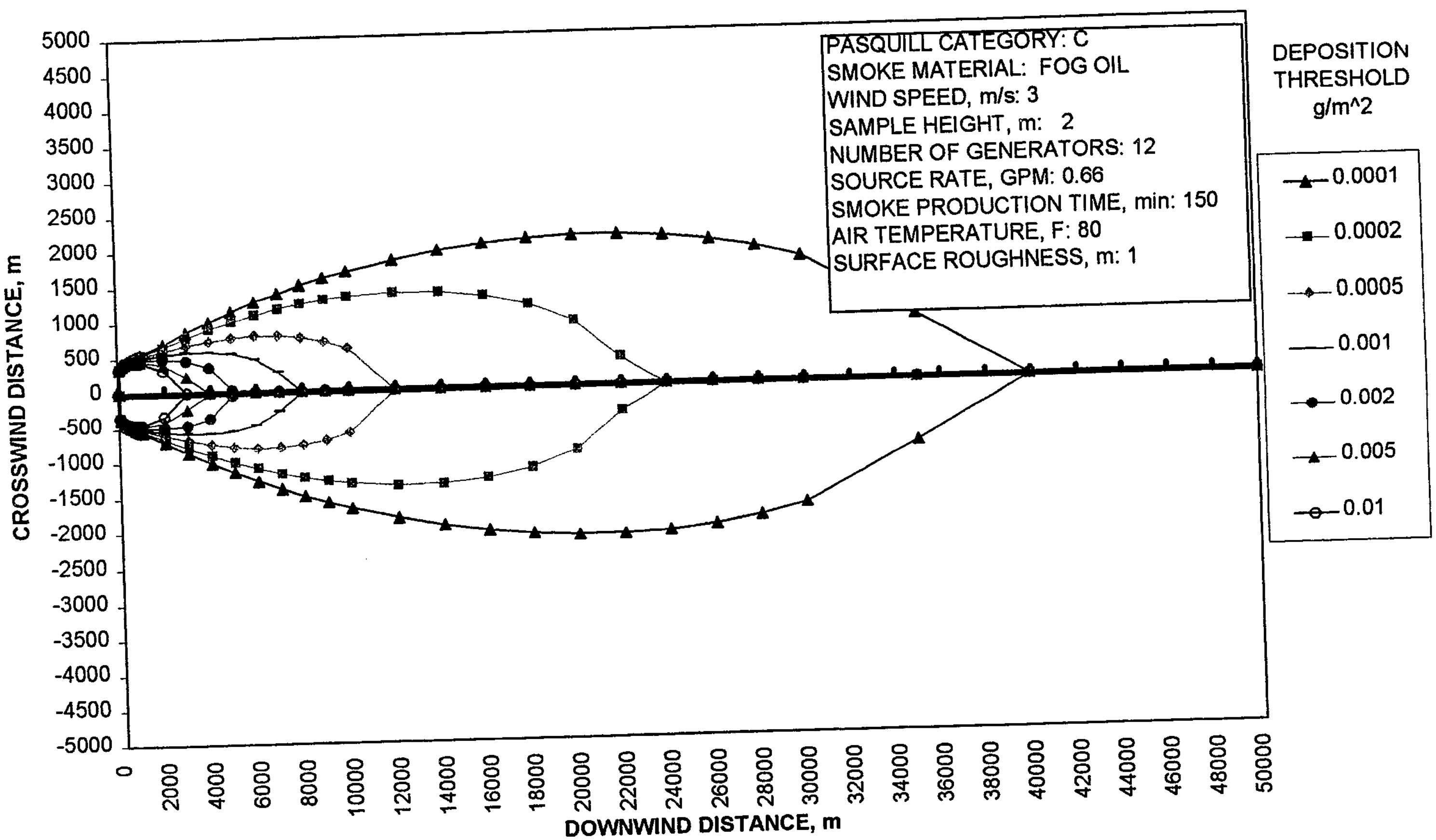
CROSSWIND DISTANCE, m
DOWNWIND DISTANCE, m


PASQUILL CATEGORY: C
SMOKE MATERIAL: FOG OIL
WIND SPEED, m/s: 3
SAMPLE HEIGHT, m: 2
NUMBER OF GENERATORS: 12
SOURCE RATE, GPM: 0.66
SMOKE PRODUCTION TIME, min: 150
AIR TEMPERATURE, F: 80
SURFACE ROUGHNESS, m: 1
DEPOSITION THRESHOLD g/m^2
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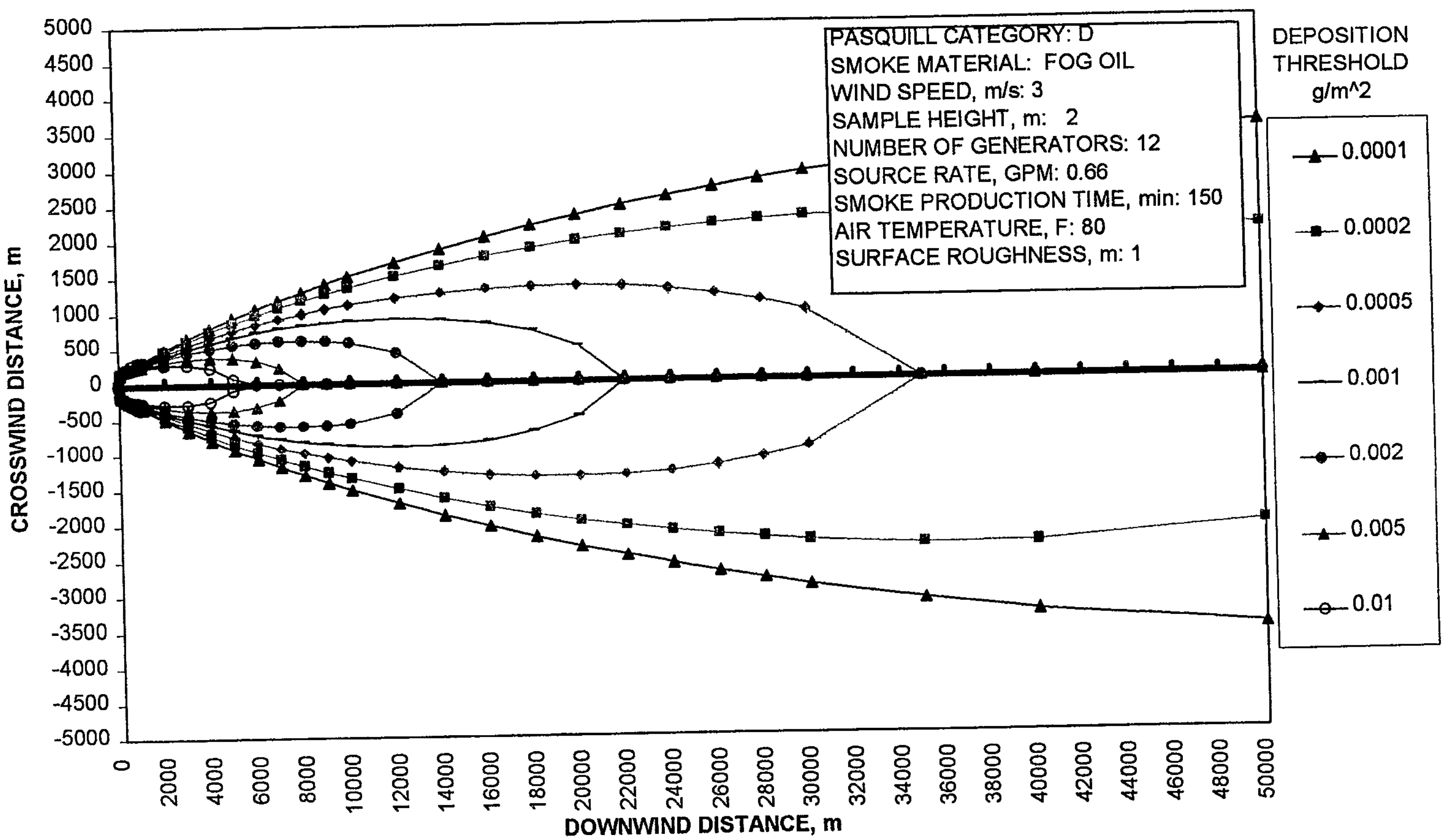
DOWNWIND DISTANCE, m



PASQUILL CATEGORY: D
SMOKE MATERIAL: FOG OIL
WIND SPEED, m/s: 3
SAMPLE HEIGHT, m: 2
NUMBER OF GENERATORS: 12
SOURCE RATE, GPM: 0.66
SMOKE PRODUCTION TIME, min: 150
AIR TEMPERATURE, F: 80
SURFACE ROUGHNESS, m: 1
DEPOSITION THRESHOLD g/m^2
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CROSSWIND DISTANCE, m
DOWNWIND DISTANCE, m
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Attachment C
Stressor Intake - Indiana Bat

INTAKE PARAMETERS FOR INDIANA BATS

Summer Foraging/Roosting Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Fog Oil Concentration		Exposure concentration.
Intake Rate		Amount of air inhaled.
Daily Intake Rate	Daily IR	Amount of air inhaled each day.
Hourly Intake Rate	Hourly IR	Amount of air inhaled each hour.
Event Intake Rate	Event IR	Amount of air inhaled during each chemical release.
Exposure Frequency	EF	Number of chemical exposures per year.
Exposure Duration	ED	Estimate of time receptor will potentially be exposed to chemical.
Body Weight	BW	Mass of adult receptor.
Averaging Time	AT	Lifespan of receptor.
Daily Chronic Intake Value		Amount of chemical stressor inhaled by receptor.

Summer Foraging/Roosting Ingestion

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Fog Oil Deposition		Exposure concentration.
Prey Surface Area	Prey SA	Size of area of the body surface of prey that might be covered by fog oil particles.
Prey Weight		Mass of prey.
Concentration of Food Contaminant	CF	Quantity of contaminant deposited on food item.
Intake Rate		Amount of food ingested during each chemical release.
Exposure Frequency	EF	Number of chemical exposures per year.
Exposure Duration	ED	Estimate of time receptor will potentially be exposed to chemical.
Body Weight	BW	Mass of adult receptor.
Averaging Time	AT	Lifespan of receptor.
Daily Chronic Intake Value		Amount of chemical stressor ingested by receptor.

Summer Foraging/Roosting Dermal Absorption

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Fog Oil Concentration		Exposure concentration.
Skin Surface Area		Surface area of receptor.
Absorption Factor	ABS	Degree of dermal absorption of stressor by receptor. Unitless - assumed to equal 1 (100% absorption).
Exposure Frequency	EF	Number of chemical exposures per year.
Exposure Duration	ED	Estimate of time receptor will potentially be exposed to chemical.
Body Weight	BW	Mass of adult receptor.
Averaging Time	AT	Lifespan of receptor.
Dermally Absorbed Dose		Amount of chemical stressor dermally absorbed by receptor.

Winter Hibernation Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Fog Oil Concentration		Exposure concentration.
Intake Rate		Amount of air inhaled.
Daily Intake Rate	Daily IR	Amount of air inhaled each day.
Hourly Intake Rate	Hourly IR	Amount of air inhaled each hour.
Event Intake Rate	Event IR	Amount of air inhaled during each chemical release.
Exposure Frequency	EF	Number of chemical exposures per year.
Exposure Duration	ED	Estimate of time receptor will potentially be exposed to chemical.
Body Weight	BW	Mass of adult receptor.
Averaging Time	AT	Lifespan of receptor.
Daily Chronic Intake Value		Amount of chemical stressor inhaled by receptor.

Winter Hibernation Dermal Absorption

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Fog Oil Concentration		Exposure concentration.
Skin Surface Area		Surface area of receptor.
Absorption Factor	ABS	Degree of dermal absorption of stressor by receptor. Unitless - assumed to equal 1 (100% absorption).
Exposure Frequency	EF	Number of chemical exposures per year.
Exposure Duration	ED	Estimate of time receptor will potentially be exposed to chemical.
Body Weight	BW	Mass of adult receptor.
Averaging Time	AT	Lifespan of receptor.
Dermally Absorbed Dose		Amount of chemical stressor dermally absorbed by receptor.

Attachment C: Fog Oil - Static Smoke

Indiana bat intake for fog oil under Pasquill Category B.

Static Smoke

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	4000	0.01	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	2.6E-07
	4000	0.005	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	1.3E-07
	5000	0.002	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	5.1E-08
	5000	0.001	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	2.6E-08
	6000	0.0005	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	1.3E-08
	8000	0.0002	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	5.1E-09
	12000	0.0001	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	2.6E-09

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging/Roosting Ingestion											
	4000	0.01	3.3E-05	3.4E-03	9.7E-05	2.5E+00	7.1	3.5	0.008	2555	2.9E-04
	5000	0.005	3.3E-05	3.4E-03	4.9E-05	2.5E+00	7.1	3.5	0.008	2555	1.5E-04
	6000	0.002	3.3E-05	3.4E-03	1.9E-05	2.5E+00	7.1	3.5	0.008	2555	5.9E-05
	7000	0.001	3.3E-05	3.4E-03	9.7E-06	2.5E+00	7.1	3.5	0.008	2555	2.9E-05
	9500	0.0005	3.3E-05	3.4E-03	4.9E-06	2.5E+00	7.1	3.5	0.008	2555	1.5E-05
	14000	0.0002	3.3E-05	3.4E-03	1.9E-06	2.5E+00	7.1	3.5	0.008	2555	5.9E-06
	20000	0.0001	3.3E-05	3.4E-03	9.7E-07	2.5E+00	7.1	3.5	0.008	2555	2.9E-06

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging/Roosting Dermal Absorption									
	4000	0.01	0.022	1	7.1	3.5	0.008	2555	2.7E-04
	5000	0.005	0.022	1	7.1	3.5	0.008	2555	1.3E-04
	6000	0.002	0.022	1	7.1	3.5	0.008	2555	5.3E-05
	7000	0.001	0.022	1	7.1	3.5	0.008	2555	2.7E-05
	9500	0.0005	0.022	1	7.1	3.5	0.008	2555	1.3E-05
	14000	0.0002	0.022	1	7.1	3.5	0.008	2555	5.3E-06
	20000	0.0001	0.022	1	7.1	3.5	0.008	2555	2.7E-06

Indiana bat intake for fog oil under Pasquill Category B.

	Distance (m)	Fog Oil Concentration (g/m³)	Intake Rate (m^3/day) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Hiberation Inhalation										
Brooks	6037	0.0002	3.4E-04	1.4E-05	3.8E-06	7.1	4.7	0.008	2555	1.2E-09
Davis #2	3927	0.01	3.4E-04	1.4E-05	1.5E-05	7.1	4.7	0.008	2555	2.5E-07
Wolf Den	3878	0.01	3.4E-04	1.4E-05	1.0E-05	7.1	4.7	0.008	2555	1.7E-07
Joy	3682	0.01	3.4E-04	1.4E-05	1.2E-05	7.1	4.7	0.008	2555	2.0E-07

	Distance (m)	Fog Oil Concentration (g/m²)	Skin Surface Area (m²)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Hibernation Dermal Absorption									
Brooks	6037	0.001	0.022	1	7.1	4.7	0.008	2555	3.6E-05
Davis #2	3927	0.01	0.022	1	7.1	4.7	0.008	2555	3.6E-04
Wolf Den	3878	0.01	0.022	1	7.1	4.7	0.008	2555	3.6E-04
Joy	3682	0.01	0.022	1	7.1	4.7	0.008	2555	3.6E-04

Indiana bat intake for fog oil under Pasquill Category C.

Static Smoke

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	3500	0.01	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	2.6E-07
	3500	0.005	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	1.3E-07
	4000	0.002	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	5.1E-08
	5500	0.001	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	2.6E-08
	7500	0.0005	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	1.3E-08
	12000	0.0002	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	5.1E-09
	18500	0.0001	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	2.6E-09

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging/Roosting Ingestion											
	3500	0.01	3.3E-05	3.4E-03	9.7E-05	2.5E+00	7.1	3.5	0.008	2555	2.9E-04
	4000	0.005	3.3E-05	3.4E-03	4.9E-05	2.5E+00	7.1	3.5	0.008	2555	1.5E-04
	5500	0.002	3.3E-05	3.4E-03	1.9E-05	2.5E+00	7.1	3.5	0.008	2555	5.9E-05
	8000	0.001	3.3E-05	3.4E-03	9.7E-06	2.5E+00	7.1	3.5	0.008	2555	2.9E-05
	12000	0.0005	3.3E-05	3.4E-03	4.9E-06	2.5E+00	7.1	3.5	0.008	2555	1.5E-05
	24000	0.0002	3.3E-05	3.4E-03	1.9E-06	2.5E+00	7.1	3.5	0.008	2555	5.9E-06
	40000	0.0001	3.3E-05	3.4E-03	9.7E-07	2.5E+00	7.1	3.5	0.008	2555	2.9E-06

	Distance (m)	Fog Oil Concentration (g/m^3)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging/Roosting Dermal Absorption									
	3500	0.01	0.022	1	7.1	3.5	0.008	2555	2.7E-04
	4000	0.005	0.022	1	7.1	3.5	0.008	2555	1.3E-04
	5500	0.002	0.022	1	7.1	3.5	0.008	2555	5.3E-05
	8000	0.001	0.022	1	7.1	3.5	0.008	2555	2.7E-05
	12000	0.0005	0.022	1	7.1	3.5	0.008	2555	1.3E-05
	24000	0.0002	0.022	1	7.1	3.5	0.008	2555	5.3E-06
	40000	0.0001	0.022	1	7.1	3.5	0.008	2555	2.7E-06

Indiana bat intake for fog oil under Pasquill Category C.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Winter Hiberation Inhalation										
Brooks	6037	0.0005	3.4E-04	1.4E-05	3.8E-06	7.1	4.7	0.008	2555	3.1E-09
Davis #2	3927	0.002	3.4E-04	1.4E-05	1.5E-05	7.1	4.7	0.008	2555	5.0E-08
Wolf Den	3878	0.002	3.4E-04	1.4E-05	1.0E-05	7.1	4.7	0.008	2555	3.4E-08
Joy	3682	0.002	3.4E-04	1.4E-05	1.2E-05	7.1	4.7	0.008	2555	3.9E-08

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Hibernation Dermal Absorption									
Brooks	6037	0.001	0.022	1	7.1	4.7	0.008	2555	3.6E-05
Davis #2	3927	0.005	0.022	1	7.1	4.7	0.008	2555	1.8E-04
Wolf Den	3878	0.005	0.022	1	7.1	4.7	0.008	2555	1.8E-04
Joy	3682	0.005	0.022	1	7.1	4.7	0.008	2555	1.8E-04

Indiana bat intake for fog oil under Pasquill Category D.

Static Smoke

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging/Roosting Inhalation										
	3500	0.01	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	2.6E-07
	4500	0.005	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	1.3E-07
	6500	0.002	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	5.1E-08
	8500	0.001	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	2.6E-08
	12500	0.0005	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	1.3E-08
	22500	0.0002	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	5.1E-09
	35500	0.0001	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	2.6E-09

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging/Roosting Ingestion											
	6500	0.01	3.3E-05	3.4E-03	9.7E-05	2.5E+00	7.1	3.5	0.008	2555	2.9E-04
	8500	0.005	3.3E-05	3.4E-03	4.9E-05	2.5E+00	7.1	3.5	0.008	2555	1.5E-04
	14000	0.002	3.3E-05	3.4E-03	1.9E-05	2.5E+00	7.1	3.5	0.008	2555	5.9E-05
	22000	0.001	3.3E-05	3.4E-03	9.7E-06	2.5E+00	7.1	3.5	0.008	2555	2.9E-05
	35500	0.0005	3.3E-05	3.4E-03	4.9E-06	2.5E+00	7.1	3.5	0.008	2555	1.5E-05
	50000+	0.0002	3.3E-05	3.4E-03	1.9E-06	2.5E+00	7.1	3.5	0.008	2555	5.9E-06
	50000++	0.0001	3.3E-05	3.4E-03	9.7E-07	2.5E+00	7.1	3.5	0.008	2555	2.9E-06

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging/Roosting Dermal Absorption									
	6500	0.01	0.022	1	7.1	3.5	0.008	2555	2.7E-04
	8500	0.005	0.022	1	7.1	3.5	0.008	2555	1.3E-04
	14000	0.002	0.022	1	7.1	3.5	0.008	2555	5.3E-05
	22000	0.001	0.022	1	7.1	3.5	0.008	2555	2.7E-05
	35500	0.0005	0.022	1	7.1	3.5	0.008	2555	1.3E-05
	50000+	0.0002	0.022	1	7.1	3.5	0.008	2555	5.3E-06
	50000++	0.0001	0.022	1	7.1	3.5	0.008	2555	2.7E-06

Indiana bat intake for fog oil under Pasquill Category D.

	Distance (m)	Fog Oil Concentration (g/m³)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Winter Hiberation Inhalation										
Brooks	6037	0.001	3.4E-04	1.4E-05	3.8E-06	7.1	4.7	0.008	2555	6.2E-09
Davis #2	3927	0.005	3.4E-04	1.4E-05	1.5E-05	7.1	4.7	0.008	2555	1.3E-07
Wolf Den	3878	0.005	3.4E-04	1.4E-05	1.0E-05	7.1	4.7	0.008	2555	8.5E-08
Joy	3682	0.005	3.4E-04	1.4E-05	1.2E-05	7.1	4.7	0.008	2555	9.8E-08

	Distance (m)	Fog Oil Concentration (g/m²)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Hibernation Dermal Absorption									
Brooks	6037	0.01	0.022	1	7.1	4.7	0.008	2555	3.6E-04
Davis #2	3927	0.01	0.022	1	7.1	4.7	0.008	2555	3.6E-04
Wolf Den	3878	0.01	0.022	1	7.1	4.7	0.008	2555	3.6E-04
Joy	3682	0.01	0.022	1	7.1	4.7	0.008	2555	3.6E-04

Indiana bat intake for fog oil under Pasquill Category E.

Static Smoke

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	4000	0.01	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	2.6E-07
	5000	0.005	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	1.3E-07
	9000	0.002	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	5.1E-08
	14000	0.001	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	2.6E-08
	24000	0.0005	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	1.3E-08
	50000	0.0002	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	5.1E-09
	50000+	0.0001	3.4E-04	1.4E-05	2.1E-05	7.1	3.5	0.008	2555	2.6E-09

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging/Roosting Ingestion											
	7500	0.01	3.3E-05	3.4E-03	9.7E-05	2.5E+00	7.1	3.5	0.008	2555	2.9E-04
	10000	0.005	3.3E-05	3.4E-03	4.9E-05	2.5E+00	7.1	3.5	0.008	2555	1.5E-04
	18000	0.002	3.3E-05	3.4E-03	1.9E-05	2.5E+00	7.1	3.5	0.008	2555	5.9E-05
	30000	0.001	3.3E-05	3.4E-03	9.7E-06	2.5E+00	7.1	3.5	0.008	2555	2.9E-05
	50000	0.0005	3.3E-05	3.4E-03	4.9E-06	2.5E+00	7.1	3.5	0.008	2555	1.5E-05
	50000+	0.0002	3.3E-05	3.4E-03	1.9E-06	2.5E+00	7.1	3.5	0.008	2555	5.9E-06
	50000++	0.0001	3.3E-05	3.4E-03	9.7E-07	2.5E+00	7.1	3.5	0.008	2555	2.9E-06

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging/Roosting Dermal Absorption									
	7500	0.01	0.022	1	7.1	3.5	0.008	2555	2.7E-04
	10000	0.005	0.022	1	7.1	3.5	0.008	2555	1.3E-04
	18000	0.002	0.022	1	7.1	3.5	0.008	2555	5.3E-05
	30000	0.001	0.022	1	7.1	3.5	0.008	2555	2.7E-05
	50000	0.0005	0.022	1	7.1	3.5	0.008	2555	1.3E-05
	50000+	0.0002	0.022	1	7.1	3.5	0.008	2555	5.3E-06
	50000++	0.0001	0.022	1	7.1	3.5	0.008	2555	2.7E-06

Indiana bat intake for fog oil under Pasquill Category E.

	Distance (m)	Fog Oil Concentration (g/m³)	Intake Rate (m^3/day) Daily IR	Intake Rate (m^3/day) Hourly IR	Intake Rate (m^3/day) Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Hiberation Inhalation										
Brooks	6037	0.002	3.4E-04	1.4E-05	3.8E-06	7.1	4.7	0.008	2555	1.2E-08
Davis #2	3927	0.01	3.4E-04	1.4E-05	1.5E-05	7.1	4.7	0.008	2555	2.5E-07
Wolf Den	3878	0.01	3.4E-04	1.4E-05	1.0E-05	7.1	4.7	0.008	2555	1.7E-07
Joy	3682	0.01	3.4E-04	1.4E-05	1.2E-05	7.1	4.7	0.008	2555	2.0E-07

	Distance (m)	Fog Oil Concentration (g/m³)	Skin Surface Area (m²)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Hibernation Dermal Absorption									
Brooks	6037	0.01	0.022	1	7.1	4.7	0.008	2555	3.6E-04
Davis #2	3927	0.01	0.022	1	7.1	4.7	0.008	2555	3.6E-04
Wolf Den	3878	0.01	0.022	1	7.1	4.7	0.008	2555	3.6E-04
Joy	3682	0.01	0.022	1	7.1	4.7	0.008	2555	3.6E-04

Attachment C: Fog Oil - Mobile Smoke

Indiana bat intake for fog oil under Pasquill Category B.

Mobile Smoke	Distance (m)	Fog Oil Concentration (g/m³)	Intake Rate (m³/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	4000	0.01	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	1.5E-06
	4000	0.005	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	7.6E-07
	4000	0.002	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	3.0E-07
	5000	0.001	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	1.5E-07
	5000	0.0005	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	7.6E-08
	7000	0.0002	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	3.0E-08
	9000	0.0001	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	1.5E-08

	Distance (m)	Fog Oil Deposition (g/m²)	Prey SA (m²)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
						Daily IR					
Summer Foraging/Roosting Ingestion											
	4000	0.01	0.0000	0.00	9.7E-05	2.5E+00	25.3	3.5	0.008	2555	1.1E-03
	5000	0.005	0.0000	0.00	4.9E-05	2.5E+00	25.3	3.5	0.008	2555	5.3E-04
	6000	0.002	0.0000	0.00	1.9E-05	2.5E+00	25.3	3.5	0.008	2555	2.1E-04
	7500	0.001	0.0000	0.00	9.7E-06	2.5E+00	25.3	3.5	0.008	2555	1.1E-04
	9500	0.0005	0.0000	0.00	4.9E-06	2.5E+00	25.3	3.5	0.008	2555	5.3E-05
	14500	0.0002	0.0000	0.00	1.9E-06	2.5E+00	25.3	3.5	0.008	2555	2.1E-05
	20000	0.0001	0.0000	0.00	9.7E-07	2.5E+00	25.3	3.5	0.008	2555	1.1E-05

	Distance (m)	Fog Oil Concentration (g/m²)	Skin Surface Area (m²)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging/Roosting Dermal Absorption									
	4000	0.01	0.022	1	25.3	3.5	0.008	2555	9.5E-04
	5000	0.005	0.022	1	25.3	3.5	0.008	2555	4.8E-04
	6000	0.002	0.022	1	25.3	3.5	0.008	2555	1.9E-04
	7500	0.001	0.022	1	25.3	3.5	0.008	2555	9.5E-05
	9500	0.0005	0.022	1	25.3	3.5	0.008	2555	4.8E-05
	14500	0.0002	0.022	1	25.3	3.5	0.008	2555	1.9E-05
	20000	0.0001	0.022	1	25.3	3.5	0.008	2555	9.5E-06

Indiana bat intake for fog oil under Pasquill Category B.

	Distance (m)	Fog Oil Concentration (g/m³)	Intake Rate (m³/day) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Hibernation Inhalation										
Musgrave Hollow										
Brooks	8031	0.0001	3.4E-04	1.4E-05	3.5E-06	25.3	4.7	0.008	2555	2.0E-09
Davis #2	6624	0.001	3.4E-04	1.4E-05	1.1E-05	25.3	4.7	0.008	2555	6.4E-08
Wolf Den	8609	0.0001	3.4E-04	1.4E-05	7.2E-06	25.3	4.7	0.008	2555	4.2E-09
Joy	5447	0.0005	3.4E-04	1.4E-05	1.2E-05	25.3	4.7	0.008	2555	3.5E-08
Baily McCann Hollow										
Brooks	5803	0.0002	3.4E-04	1.4E-05	3.8E-06	19.0	4.7	0.008	2555	3.3E-09
Davis #2	2423	0.01	3.4E-04	1.4E-05	1.5E-05	19.0	4.7	0.008	2555	6.7E-07
Wolf Den	3861	0.01	3.4E-04	1.4E-05	1.0E-05	19.0	4.7	0.008	2555	4.5E-07
Joy	2004	0.01	3.4E-04	1.4E-05	1.2E-05	19.0	4.7	0.008	2555	5.3E-07
Mush Paddle Hollow										
Brooks	10335	0	3.4E-04	1.4E-05	0.0E+00	15.8	4.7	0.008	2555	0.0E+00
Davis #2	2889	0.01	3.4E-04	1.4E-05	1.5E-05	15.8	4.7	0.008	2555	5.6E-07
Wolf Den	8432	0.0001	3.4E-04	1.4E-05	7.2E-06	15.8	4.7	0.008	2555	2.6E-09
Joy	1751	0.01	3.4E-04	1.4E-05	9.3E-06	15.8	4.7	0.008	2555	3.4E-07
Ballard Hollow										
Brooks	8449	0.0001	3.4E-04	1.4E-05	3.5E-06	12.7	4.7	0.008	2555	1.0E-09
Davis #2	13352	0	3.4E-04	1.4E-05	0.0E+00	12.7	4.7	0.008	2555	0.0E+00
Wolf Den	6859	0.0002	3.4E-04	1.4E-05	7.7E-06	12.7	4.7	0.008	2555	4.5E-09
Joy	13821	0	3.4E-04	1.4E-05	0.0E+00	12.7	4.7	0.008	2555	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m²)	Skin Surface Area (m²)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Hibernation Dermal Absorption									
Musgrave Hollow									
Brooks	8031	0.0005	0.022	1	25.3	4.7	0.008	2555	6.4E-05
Davis #2	6624	0.0001	0.022	1	25.3	4.7	0.008	2555	1.3E-05
Wolf Den	8609	0.0005	0.022	1	25.3	4.7	0.008	2555	6.4E-05
Joy	5447	0.0002	0.022	1	25.3	4.7	0.008	2555	2.6E-05
Baily McCann Hollow									
Brooks	5803	0.0002	0.022	1	19.0	4.7	0.008	2555	1.9E-05
Davis #2	2423	0.01	0.022	1	19.0	4.7	0.008	2555	9.6E-04
Wolf Den	3861	0.01	0.022	1	19.0	4.7	0.008	2555	9.6E-04
Joy	2004	0.01	0.022	1	19.0	4.7	0.008	2555	9.6E-04
Mush Paddle Hollow									
Brooks	10335	0.0002	0.022	1	15.8	4.7	0.008	2555	1.6E-05
Davis #2	2889	0.01	0.022	1	15.8	4.7	0.008	2555	8.0E-04
Wolf Den	8432	0.0005	0.022	1	15.8	4.7	0.008	2555	4.0E-05
Joy	1751	0.01	0.022	1	15.8	4.7	0.008	2555	8.0E-04
Ballard Hollow									
Brooks	8449	0.0005	0.022	1	12.7	4.7	0.008	2555	3.2E-05
Davis #2	13352	0.0002	0.022	1	12.7	4.7	0.008	2555	1.3E-05
Wolf Den	6859	0.001	0.022	1	12.7	4.7	0.008	2555	6.4E-05
Joy	13821	0.0002	0.022	1	12.7	4.7	0.008	2555	1.3E-05

Indiana bat intake for fog oil under Pasquill Category C.

Mobile Smoke

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day) Daily IR	Intake Rate (m^3/day) Hourly IR	Intake Rate (m^3/day) Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging/Roosting Inhalation										
	3000	0.01	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	1.5E-06
	3000	0.005	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	7.6E-07
	3000	0.002	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	3.0E-07
	4500	0.001	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	1.5E-07
	6500	0.0005	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	7.6E-08
	9500	0.0002	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	3.0E-08
	14000	0.0001	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	1.5E-08

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day) Daily IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging/Roosting Ingestion											
	3000	0.01	0.0000	0.00	9.7E-05	2.5E+00	25.3	3.5	0.008	2555	1.1E-03
	4000	0.005	0.0000	0.00	4.9E-05	2.5E+00	25.3	3.5	0.008	2555	5.3E-04
	5000	0.002	0.0000	0.00	1.9E-05	2.5E+00	25.3	3.5	0.008	2555	2.1E-04
	8500	0.001	0.0000	0.00	9.7E-06	2.5E+00	25.3	3.5	0.008	2555	1.1E-04
	12000	0.0005	0.0000	0.00	4.9E-06	2.5E+00	25.3	3.5	0.008	2555	5.3E-05
	24000	0.0002	0.0000	0.00	1.9E-06	2.5E+00	25.3	3.5	0.008	2555	2.1E-05
	40000	0.0001	0.0000	0.00	9.7E-07	2.5E+00	25.3	3.5	0.008	2555	1.1E-05

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging/Roosting Dermal Absorption									
	3000	0.01	0.022	1	25.3	3.5	0.008	2555	9.5E-04
	4000	0.005	0.022	1	25.3	3.5	0.008	2555	4.8E-04
	5000	0.002	0.022	1	25.3	3.5	0.008	2555	1.9E-04
	8500	0.001	0.022	1	25.3	3.5	0.008	2555	9.5E-05
	12000	0.0005	0.022	1	25.3	3.5	0.008	2555	4.8E-05
	24000	0.0002	0.022	1	25.3	3.5	0.008	2555	1.9E-05
	40000	0.0001	0.022	1	25.3	3.5	0.008	2555	9.5E-06

Indiana bat intake for fog oil under Pasquill Category C.

	Distance (m)	Fog Oil Concentration (g/m³)	Intake Rate (m³/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Winter Hibernation Inhalation										
Musgrave Hollow										
Brooks	8031	0.0002	3.4E-04	1.4E-05	3.5E-06	25.3	4.7	0.008	2555	4.1E-09
Davis #2	6624	0.0002	3.4E-04	1.4E-05	1.1E-05	25.3	4.7	0.008	2555	1.3E-08
Wolf Den	8609	0.0002	3.4E-04	1.4E-05	7.2E-06	25.3	4.7	0.008	2555	8.3E-09
Joy	5447	0.0005	3.4E-04	1.4E-05	1.2E-05	25.3	4.7	0.008	2555	3.5E-08
Bally McCann Hollow										
Brooks	5803	0.0005	3.4E-04	1.4E-05	3.8E-06	19.0	4.7	0.008	2555	8.3E-09
Davis #2	2423	0.01	3.4E-04	1.4E-05	1.5E-05	19.0	4.7	0.008	2555	6.7E-07
Wolf Den	3861	0.001	3.4E-04	1.4E-05	1.0E-05	19.0	4.7	0.008	2555	4.5E-08
Joy	2004	0.01	3.4E-04	1.4E-05	1.2E-05	19.0	4.7	0.008	2555	5.3E-07
Mush Paddle Hollow										
Brooks	10335	0.0001	3.4E-04	1.4E-05	0.0E+00	15.8	4.7	0.008	2555	0.0E+00
Davis #2	2889	0.01	3.4E-04	1.4E-05	1.5E-05	15.8	4.7	0.008	2555	5.6E-07
Wolf Den	8432	0.0002	3.4E-04	1.4E-05	7.2E-06	15.8	4.7	0.008	2555	5.2E-09
Joy	1751	0.01	3.4E-04	1.4E-05	9.3E-06	15.8	4.7	0.008	2555	3.4E-07
Ballard Hollow										
Brooks	8449	0.0002	3.4E-04	1.4E-05	3.5E-06	12.7	4.7	0.008	2555	2.0E-09
Davis #2	13352	0.0001	3.4E-04	1.4E-05	0.0E+00	12.7	4.7	0.008	2555	0.0E+00
Wolf Den	6859	0.0002	3.4E-04	1.4E-05	7.7E-06	12.7	4.7	0.008	2555	4.5E-09
Joy	13821	0.0001	3.4E-04	1.4E-05	0.0E+00	12.7	4.7	0.008	2555	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m²)	Skin Surface Area (m²)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Hibernation Dermal Absorption									
Musgrave Hollow									
Brooks	8031	0.001	0.022	1	25.3	4.7	0.008	2555	1.3E-04
Davis #2	6624	0.001	0.022	1	25.3	4.7	0.008	2555	1.3E-04
Wolf Den	8609	0.0005	0.022	1	25.3	4.7	0.008	2555	6.4E-05
Joy	5447	0.001	0.022	1	25.3	4.7	0.008	2555	1.3E-04
Bally McCann Hollow									
Brooks	5803	0.001	0.022	1	19.0	4.7	0.008	2555	9.6E-05
Davis #2	2423	0.01	0.022	1	19.0	4.7	0.008	2555	9.6E-04
Wolf Den	3861	0.005	0.022	1	19.0	4.7	0.008	2555	4.8E-04
Joy	2004	0.01	0.022	1	19.0	4.7	0.008	2555	9.6E-04
Mush Paddle Hollow									
Brooks	10335	0.0005	0.022	1	15.8	4.7	0.008	2555	4.0E-05
Davis #2	2889	0.01	0.022	1	15.8	4.7	0.008	2555	8.0E-04
Wolf Den	8432	0.001	0.022	1	15.8	4.7	0.008	2555	8.0E-05
Joy	1751	0.01	0.022	1	15.8	4.7	0.008	2555	8.0E-04
Ballard Hollow									
Brooks	8449	0.001	0.022	1	12.7	4.7	0.008	2555	6.4E-05
Davis #2	13352	0.0002	0.022	1	12.7	4.7	0.008	2555	1.3E-05
Wolf Den	6859	0.001	0.022	1	12.7	4.7	0.008	2555	6.4E-05
Joy	13821	0.0002	0.022	1	12.7	4.7	0.008	2555	1.3E-05

Indiana bat intake for fog oil under Pasquill Category D.

Mobile Smoke	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	2500	0.01	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	1.5E-06
	3000	0.005	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	7.6E-07
	4500	0.002	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	3.0E-07
	6000	0.001	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	1.5E-07
	9500	0.0005	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	7.6E-08
	16500	0.0002	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	3.0E-08
	26500	0.0001	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	1.5E-08

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
						Daily IR					
Summer Foraging/Roosting Ingestion											
	6500	0.01	0.0000	0.00	9.7E-05	2.5E+00	25.3	3.5	0.008	2555	1.1E-03
	8500	0.005	0.0000	0.00	4.9E-05	2.5E+00	25.3	3.5	0.008	2555	5.3E-04
	14500	0.002	0.0000	0.00	1.9E-05	2.5E+00	25.3	3.5	0.008	2555	2.1E-04
	22000	0.001	0.0000	0.00	9.7E-06	2.5E+00	25.3	3.5	0.008	2555	1.1E-04
	35500	0.0005	0.0000	0.00	4.9E-06	2.5E+00	25.3	3.5	0.008	2555	5.3E-05
	50000+	0.0002	0.0000	0.00	1.9E-06	2.5E+00	25.3	3.5	0.008	2555	2.1E-05
	50000++	0.0001	0.0000	0.00	9.7E-07	2.5E+00	25.3	3.5	0.008	2555	1.1E-05

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging/Roosting Dermal Absorption									
	6500	0.01	0.022	1	25.3	3.5	0.008	2555	9.5E-04
	8500	0.005	0.022	1	25.3	3.5	0.008	2555	4.8E-04
	14500	0.002	0.022	1	25.3	3.5	0.008	2555	1.9E-04
	22000	0.001	0.022	1	25.3	3.5	0.008	2555	9.5E-05
	35500	0.0005	0.022	1	25.3	3.5	0.008	2555	4.8E-05
	50000+	0.0002	0.022	1	25.3	3.5	0.008	2555	1.9E-05
	50000++	0.0001	0.022	1	25.3	3.5	0.008	2555	9.5E-06

Indiana bat intake for fog oil under Pasquill Category D.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Hibernation Inhalation										
Musgrave Hollow										
Brooks	8031	0.0005	3.4E-04	1.4E-05	3.5E-06	25.3	4.7	0.008	2555	1.0E-08
Davis #2	6624	0.0005	3.4E-04	1.4E-05	1.1E-05	25.3	4.7	0.008	2555	3.2E-08
Wolf Den	8609	0.0005	3.4E-04	1.4E-05	7.2E-06	25.3	4.7	0.008	2555	2.1E-08
Joy	5447	0.001	3.4E-04	1.4E-05	1.2E-05	25.3	4.7	0.008	2555	7.0E-08
Bally McCann Hollow										
Brooks	5803	0.001	3.4E-04	1.4E-05	3.8E-06	19.0	4.7	0.008	2555	1.7E-08
Davis #2	2423	0.01	3.4E-04	1.4E-05	1.5E-05	19.0	4.7	0.008	2555	6.7E-07
Wolf Den	3861	0.002	3.4E-04	1.4E-05	1.0E-05	19.0	4.7	0.008	2555	9.1E-08
Joy	2004	0.01	3.4E-04	1.4E-05	1.2E-05	19.0	4.7	0.008	2555	5.3E-07
Mush Paddle Hollow										
Brooks	10335	0.0002	3.4E-04	1.4E-05	0.0E+00	15.8	4.7	0.008	2555	0.0E+00
Davis #2	2889	0.01	3.4E-04	1.4E-05	1.5E-05	15.8	4.7	0.008	2555	5.6E-07
Wolf Den	8432	0.0005	3.4E-04	1.4E-05	7.2E-06	15.8	4.7	0.008	2555	1.3E-08
Joy	1751	0.01	3.4E-04	1.4E-05	9.3E-06	15.8	4.7	0.008	2555	3.4E-07
Ballard Hollow										
Brooks	8449	0.0005	3.4E-04	1.4E-05	3.5E-06	12.7	4.7	0.008	2555	5.1E-09
Davis #2	13352	0.0002	3.4E-04	1.4E-05	0.0E+00	12.7	4.7	0.008	2555	0.0E+00
Wolf Den	6859	0.0005	3.4E-04	1.4E-05	7.7E-06	12.7	4.7	0.008	2555	1.1E-08
Joy	13821	0.0002	3.4E-04	1.4E-05	0.0E+00	12.7	4.7	0.008	2555	0.0E+00
	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)		ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Hibernation Dermal Absorption										
Musgrave Hollow										
Brooks	8031	0.005	0.022		1	25.3	4.7	0.008	2555	6.4E-04
Davis #2	6624	0.005	0.022		1	25.3	4.7	0.008	2555	6.4E-04
Wolf Den	8609	0.002	0.022		1	25.3	4.7	0.008	2555	2.6E-04
Joy	5447	0.01	0.022		1	25.3	4.7	0.008	2555	1.3E-03
Bally McCann Hollow										
Brooks	5803	0.01	0.022		1	19.0	4.7	0.008	2555	9.6E-04
Davis #2	2423	0.01	0.022		1	19.0	4.7	0.008	2555	9.6E-04
Wolf Den	3861	0.01	0.022		1	19.0	4.7	0.008	2555	9.6E-04
Joy	2004	0.01	0.022		1	19.0	4.7	0.008	2555	9.6E-04
Mush Paddle Hollow										
Brooks	10335	0.002	0.022		1	15.8	4.7	0.008	2555	1.6E-04
Davis #2	2889	0.01	0.022		1	15.8	4.7	0.008	2555	8.0E-04
Wolf Den	8432	0.005	0.022		1	15.8	4.7	0.008	2555	4.0E-04
Joy	1751	0.01	0.022		1	15.8	4.7	0.008	2555	8.0E-04
Ballard Hollow										
Brooks	8449	0.005	0.022		1	12.7	4.7	0.008	2555	3.2E-04
Davis #2	13352	0.002	0.022		1	12.7	4.7	0.008	2555	1.3E-04
Wolf Den	6859	0.005	0.022		1	12.7	4.7	0.008	2555	3.2E-04
Joy	13821	0.002	0.022		1	12.7	4.7	0.008	2555	1.3E-04

Indiana bat intake for fog oil under Pasquill Category E.

Mobile Smoke	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	3000	0.01	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	1.5E-06
	4000	0.005	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	7.6E-07
	7000	0.002	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	3.0E-07
	10000	0.001	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	1.5E-07
	16000	0.0005	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	7.6E-08
	30000	0.0002	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	3.0E-08
	50000	0.0001	3.4E-04	1.4E-05	3.5E-05	25.3	3.5	0.008	2555	1.5E-08

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
						Daily IR					
Summer Foraging/Roosting Ingestion											
	7500	0.01	0.0000	0.00	9.7E-05	2.5E+00	25.3	3.5	0.008	2555	1.1E-03
	10000	0.005	0.0000	0.00	4.9E-05	2.5E+00	25.3	3.5	0.008	2555	5.3E-04
	18000	0.002	0.0000	0.00	1.9E-05	2.5E+00	25.3	3.5	0.008	2555	2.1E-04
	30000	0.001	0.0000	0.00	9.7E-06	2.5E+00	25.3	3.5	0.008	2555	1.1E-04
	50000	0.0005	0.0000	0.00	4.9E-06	2.5E+00	25.3	3.5	0.008	2555	5.3E-05
	50000+	0.0002	0.0000	0.00	1.9E-06	2.5E+00	25.3	3.5	0.008	2555	2.1E-05
	50000++	0.0001	0.0000	0.00	9.7E-07	2.5E+00	25.3	3.5	0.008	2555	1.1E-05

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging/Roosting Dermal Absorption									
	7500	0.01	0.022	1	25.3	3.5	0.008	2555	9.5E-04
	10000	0.005	0.022	1	25.3	3.5	0.008	2555	4.8E-04
	18000	0.002	0.022	1	25.3	3.5	0.008	2555	1.9E-04
	30000	0.001	0.022	1	25.3	3.5	0.008	2555	9.5E-05
	50000	0.0005	0.022	1	25.3	3.5	0.008	2555	4.8E-05
	50000+	0.0002	0.022	1	25.3	3.5	0.008	2555	1.9E-05
	50000++	0.0001	0.022	1	25.3	3.5	0.008	2555	9.5E-06

Indiana bat intake for fog oil under Pasquill Category E.

	Distance (m)	Fog Oil Concentration (g/m³)	Intake Rate (m³/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Winter Hibernation Inhalation										
Musgrave Hollow										
Brooks	8031	0.001	3.4E-04	1.4E-05	3.5E-06	25.3	4.7	0.008	2555	2.0E-08
Davis #2	6624	0.002	3.4E-04	1.4E-05	1.1E-05	25.3	4.7	0.008	2555	1.3E-07
Wolf Den	8609	0.001	3.4E-04	1.4E-05	7.2E-06	25.3	4.7	0.008	2555	4.2E-08
Joy	5447	0.002	3.4E-04	1.4E-05	1.2E-05	25.3	4.7	0.008	2555	1.4E-07
Bally McCann Hollow										
Brooks	5803	0.002	3.4E-04	1.4E-05	3.8E-06	19.0	4.7	0.008	2555	3.3E-08
Davis #2	2423	0.01	3.4E-04	1.4E-05	1.5E-05	19.0	4.7	0.008	2555	6.7E-07
Wolf Den	3861	0.005	3.4E-04	1.4E-05	1.0E-05	19.0	4.7	0.008	2555	2.3E-07
Joy	2004	0.01	3.4E-04	1.4E-05	1.2E-05	19.0	4.7	0.008	2555	5.3E-07
Mush Paddle Hollow										
Brooks	10335	0.0005	3.4E-04	1.4E-05	0.0E+00	15.8	4.7	0.008	2555	0.0E+00
Davis #2	2889	0.01	3.4E-04	1.4E-05	1.5E-05	15.8	4.7	0.008	2555	5.6E-07
Wolf Den	8432	0.0001	3.4E-04	1.4E-05	7.2E-06	15.8	4.7	0.008	2555	2.6E-09
Joy	1751	0.01	3.4E-04	1.4E-05	9.3E-06	15.8	4.7	0.008	2555	3.4E-07
Ballard Hollow										
Brooks	8449	0.001	3.4E-04	1.4E-05	3.5E-06	12.7	4.7	0.008	2555	1.0E-08
Davis #2	13352	0.0005	3.4E-04	1.4E-05	0.0E+00	12.7	4.7	0.008	2555	0.0E+00
Wolf Den	6859	0.002	3.4E-04	1.4E-05	7.7E-06	12.7	4.7	0.008	2555	4.5E-08
Joy	13821	0.0005	3.4E-04	1.4E-05	0.0E+00	12.7	4.7	0.008	2555	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m²)	Skin Surface Area (m²)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Hibernation Dermal Absorption									
Musgrave Hollow									
Brooks	8031	0.005	0.022	1	25.3	4.7	0.008	2555	6.4E-04
Davis #2	6624	0.01	0.022	1	25.3	4.7	0.008	2555	1.3E-03
Wolf Den	8609	0.005	0.022	1	25.3	4.7	0.008	2555	6.4E-04
Joy	5447	0.01	0.022	1	25.3	4.7	0.008	2555	1.3E-03
Bally McCann Hollow									
Brooks	5803	0.01	0.022	1	19.0	4.7	0.008	2555	9.6E-04
Davis #2	2423	0.01	0.022	1	19.0	4.7	0.008	2555	9.6E-04
Wolf Den	3861	0.01	0.022	1	19.0	4.7	0.008	2555	9.6E-04
Joy	2004	0.01	0.022	1	19.0	4.7	0.008	2555	9.6E-04
Mush Paddle Hollow									
Brooks	10335	0.002	0.022	1	15.8	4.7	0.008	2555	1.6E-04
Davis #2	2889	0.01	0.022	1	15.8	4.7	0.008	2555	8.0E-04
Wolf Den	8432	0.005	0.022	1	15.8	4.7	0.008	2555	4.0E-04
Joy	1751	0.01	0.022	1	15.8	4.7	0.008	2555	8.0E-04
Ballard Hollow									
Brooks	8449	0.005	0.022	1	12.7	4.7	0.008	2555	3.2E-04
Davis #2	13352	0.002	0.022	1	12.7	4.7	0.008	2555	1.3E-04
Wolf Den	6859	0.005	0.022	1	12.7	4.7	0.008	2555	3.2E-04
Joy	13821	0.002	0.022	1	12.7	4.7	0.008	2555	1.3E-04

Attachment C: Terephthalic Acid (TPA) Grenades

Indiana bat intake for TPA under Pasquill Category B.

TPA Smoke Grenade	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	3136	3.5	0.008	2555	2.9E-03
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	3136	3.5	0.008	2555	1.6E-06
	4000	0.002	3.4E-04	1.4E-05	5.9E-07	3136	3.5	0.008	2555	6.3E-07
	4000	0.001	3.4E-04	1.4E-05	5.9E-07	3136	3.5	0.008	2555	3.2E-07
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	3136	3.5	0.008	2555	1.6E-07
	5000	0.0002	3.4E-04	1.4E-05	5.9E-07	3136	3.5	0.008	2555	6.3E-08
	6000	0.0001	3.4E-04	1.4E-05	5.9E-07	3136	3.5	0.008	2555	3.2E-08

	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Winter Hiberation Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	3136	4.7	0.008	2555	3.8E-03
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	3136	4.7	0.008	2555	2.1E-06
	4000	0.002	3.4E-04	1.4E-05	5.9E-07	3136	4.7	0.008	2555	8.5E-07
	4000	0.001	3.4E-04	1.4E-05	5.9E-07	3136	4.7	0.008	2555	4.3E-07
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	3136	4.7	0.008	2555	2.1E-07
	5000	0.0002	3.4E-04	1.4E-05	5.9E-07	3136	4.7	0.008	2555	8.5E-08
	6000	0.0001	3.4E-04	1.4E-05	5.9E-07	3136	4.7	0.008	2555	4.3E-08

Attachment C: TPA Smoke Pots

Indiana bat intake for TPA under Pasquill Category B.

TPA Smoke Pots										
	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	950	3.5	0.008	2555	8.6E-04
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	950	3.5	0.008	2555	4.8E-07
	5000	0.002	3.4E-04	1.4E-05	5.9E-07	950	3.5	0.008	2555	1.9E-07
	5000	0.001	3.4E-04	1.4E-05	5.9E-07	950	3.5	0.008	2555	9.6E-08
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	950	3.5	0.008	2555	4.8E-08
	6000	0.0002	3.4E-04	1.4E-05	5.9E-07	950	3.5	0.008	2555	1.9E-08
	7000	0.0001	3.4E-04	1.4E-05	5.9E-07	950	3.5	0.008	2555	9.6E-09

	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Winter Hiberation Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	950	4.7	0.008	2555	1.2E-03
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	950	4.7	0.008	2555	6.4E-07
	5000	0.002	3.4E-04	1.4E-05	5.9E-07	950	4.7	0.008	2555	2.6E-07
	5000	0.001	3.4E-04	1.4E-05	5.9E-07	950	4.7	0.008	2555	1.3E-07
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	950	4.7	0.008	2555	6.4E-08
	6000	0.0002	3.4E-04	1.4E-05	5.9E-07	950	4.7	0.008	2555	2.6E-08
	7000	0.0001	3.4E-04	1.4E-05	5.9E-07	950	4.7	0.008	2555	1.3E-08

Attachment C: Titanium Dioxide Grenades

Indiana bat intake for titanium dioxide under Pasquill Category E.

	Distance (m)	Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	100	0.01	3.4E-04	1.4E-05	5.9E-07	48	3.5	0.008	2555	4.8E-08
	300	0.005	3.4E-04	1.4E-05	5.9E-07	48	3.5	0.008	2555	2.4E-08
	500	0.002	3.4E-04	1.4E-05	5.9E-07	48	3.5	0.008	2555	9.7E-09
	700	0.001	3.4E-04	1.4E-05	5.9E-07	48	3.5	0.008	2555	4.8E-09
	1000	0.0005	3.4E-04	1.4E-05	5.9E-07	48	3.5	0.008	2555	2.4E-09
	1400	0.0002	3.4E-04	1.4E-05	5.9E-07	48	3.5	0.008	2555	9.7E-10
	1800	0.0001	3.4E-04	1.4E-05	5.9E-07	48	3.5	0.008	2555	4.8E-10

	Distance (m)	Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Winter Hiberation Inhalation										
	100	0.01	3.4E-04	1.4E-05	5.9E-07	48	4.7	0.008	2555	6.5E-08
	300	0.005	3.4E-04	1.4E-05	5.9E-07	48	4.7	0.008	2555	3.3E-08
	500	0.002	3.4E-04	1.4E-05	5.9E-07	48	4.7	0.008	2555	1.3E-08
	700	0.001	3.4E-04	1.4E-05	5.9E-07	48	4.7	0.008	2555	6.5E-09
	1000	0.0005	3.4E-04	1.4E-05	5.9E-07	48	4.7	0.008	2555	3.3E-09
	1400	0.0002	3.4E-04	1.4E-05	5.9E-07	48	4.7	0.008	2555	1.3E-09
	1800	0.0001	3.4E-04	1.4E-05	5.9E-07	48	4.7	0.008	2555	6.5E-10

Attachment D
Stressor Intake - Gray bat

INTAKE PARAMETERS FOR GRAY BATS

Summer Foraging Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Fog Oil Concentration		Exposure concentration.
Intake Rate		Amount of air inhaled.
Daily Intake Rate	Daily IR	Amount of air inhaled each day.
Hourly Intake Rate	Hourly IR	Amount of air inhaled each hour.
Event Intake Rate	Event IR	Amount of air inhaled during each chemical release.
Exposure Frequency	EF	Number of chemical exposures per year.
Exposure Duration	ED	Estimate of time receptor will potentially be exposed to chemical.
Body Weight	BW	Mass of adult receptor.
Averaging Time	AT	Lifespan of receptor.
Daily Chronic Intake Value		Amount of chemical stressor inhaled by receptor.

Summer Foraging Ingestion

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Fog Oil Déposition		Exposure concentration.
Prey Surface Area	Prey SA	Size of area of the body surface of prey that might be covered by fog oil particles.
Prey Weight		Mass of prey
Concentration of Food Contaminant	CF	Quantity of contaminant deposited on food item.
Intake Rate		Amount of food ingested during each chemical release.
Exposure Frequency	EF	Number of chemical exposures per year.
Exposure Duration	ED	Estimate of time receptor will potentially be exposed to chemical.
Body Weight	BW	Mass of adult receptor.
Averaging Time	AT	Lifespan of receptor.
Daily Chronic Intake Value		Amount of chemical stressor ingested by receptor.

Summer Foraging Dermal Absorption

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Fog Oil Concentration		Exposure concentration.
Skin Surface Area		Surface area of receptor.
Absorption Factor	ABS	Degree of dermal absorption of stressor by receptor. Unitless - assumed to equal 1 (100% absorption).
Exposure Frequency	EF	Number of chemical exposures per year.
Exposure Duration	ED	Estimate of time receptor will potentially be exposed to chemical.
Body Weight	BW	Mass of adult receptor.
Averaging Time	AT	Lifespan of receptor.
Dermally Absorbed Dose		Amount of chemical stressor dermally absorbed by receptor.

Maternity Cave Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Fog Oil Concentration		Exposure concentration.
Intake Rate		Amount of air inhaled.
Daily Intake Rate	Daily IR	Amount of air inhaled each day.
Hourly Intake Rate	Hourly IR	Amount of air inhaled each hour.
Event Intake Rate	Event IR	Amount of air inhaled during each chemical release.
Exposure Frequency	EF	Number of chemical exposures per year.
Exposure Duration	ED	Estimate of time receptor will potentially be exposed to chemical.
Body Weight	BW	Mass of adult receptor.
Averaging Time	AT	Lifespan of receptor.
Daily Chronic Intake Value		Amount of chemical stressor inhaled by receptor.

Maternity Cave Dermal Absorption

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Fog Oil Concentration		Exposure concentration.
Skin Surface Area		Surface area of receptor.
Absorption Factor	ABS	Degree of dermal absorption of stressor by receptor. Unitless - assumed to equal 1 (100% absorption).
Exposure Frequency	EF	Number of chemical exposures per year.
Exposure Duration	ED	Estimate of time receptor will potentially be exposed to chemical.
Body Weight	BW	Mass of adult receptor.
Averaging Time	AT	Lifespan of receptor.
Dermally Absorbed Dose		Amount of chemical stressor dermally absorbed by receptor.

Gray bat intake for fog oil under Pasquill Category B.

Static Smoke

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging Inhalation										
	4000	0.01	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	2.3E-07
	4000	0.005	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	1.1E-07
	5000	0.002	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	4.5E-08
	5000	0.001	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	2.3E-08
	6000	0.0005	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	1.1E-08
	8000	0.0002	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	4.5E-09
	12000	0.0001	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	2.3E-09

*Acute critical effects are oil pneumonia, nasal hemorrhaging, and convulsions. Critical Study: Shinn et al. 1987

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging Ingestion											
	4000	0.01	3.3E-05	3.4E-03	9.7E-05	2.5E+00	7.1	5.8	0.01	3650	2.6E-04
	5000	0.005	3.3E-05	3.4E-03	4.9E-05	2.5E+00	7.1	5.8	0.0105	3650	1.3E-04
	6000	0.002	3.3E-05	3.4E-03	1.9E-05	2.5E+00	7.1	5.8	0.0105	3650	5.2E-05
	7000	0.001	3.3E-05	3.4E-03	9.7E-06	2.5E+00	7.1	5.8	0.0105	3650	2.6E-05
	9500	0.0005	3.3E-05	3.4E-03	4.9E-06	2.5E+00	7.1	5.8	0.0105	3650	1.3E-05
	14000	0.0002	3.3E-05	3.4E-03	1.9E-06	2.5E+00	7.1	5.8	0.0105	3650	5.2E-06
	8500	0.0001	3.3E-05	3.4E-03	9.7E-07	2.5E+00	7.1	5.8	0.0105	3650	2.6E-06

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging Dermal Absorption									
	4000	0.01	0.026	1	7.1	5.8	0.0105	3650	2.8E-04
	5000	0.005	0.026	1	7.1	5.8	0.0105	3650	1.4E-04
	6000	0.002	0.026	1	7.1	5.8	0.0105	3650	5.6E-05
	7000	0.001	0.026	1	7.1	5.8	0.0105	3650	2.8E-05
	9500	0.0005	0.026	1	7.1	5.8	0.0105	3650	1.4E-05
	14000	0.0002	0.026	1	7.1	5.8	0.0105	3650	5.6E-06
	8500	0.0001	0.026	1	7.1	5.8	0.0105	3650	2.8E-06

Gray bat intake for fog oil under Pasquill Category B.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Maternity Cave Inhalation										
Saltpeter #3	3682	0.01	3.4E-04	1.4E-05	1.0E-04	7.1	5.8	0.0105	3650	1.1E-06
Freeman	12547	0	3.4E-04	1.4E-05	0.0E+00	7.1	5.8	0.0105	3650	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Maternity Cave Dermal Absorption									
Saltpeter #3	3682	0.01	0.026	1	7.1	5.8	0.0105	3650	2.8E-04
Freeman	12547	0.0002	0.026	1	7.1	5.8	0.0105	3650	5.6E-06

Gray bat intake for fog oil under Pasquill Category C.

Static Smoke

	Distance (m)	Fog Oil Concentration (g/m³)	Intake Rate (m³)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging Inhalation										
	3500	0.01	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	2.3E-07
	3500	0.005	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	1.1E-07
	4000	0.002	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	4.5E-08
	5500	0.001	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	2.3E-08
	7500	0.0005	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	1.1E-08
	12000	0.0002	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	4.5E-09
	18500	0.0001	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	2.3E-09

	Distance (m)	Fog Oil Deposition (g/m²)	Prey SA (m²)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging Ingestion											
	3500	0.01	3.3E-05	3.4E-03	9.7E-05	2.5E+00	7.1	5.8	0.0105	3650	2.6E-04
	4000	0.005	3.3E-05	3.4E-03	4.9E-05	2.5E+00	7.1	5.8	0.0105	3650	1.3E-04
	5500	0.002	3.3E-05	3.4E-03	1.9E-05	2.5E+00	7.1	5.8	0.0105	3650	5.2E-05
	8000	0.001	3.3E-05	3.4E-03	9.7E-06	2.5E+00	7.1	5.8	0.0105	3650	2.6E-05
	12000	0.0005	3.3E-05	3.4E-03	4.9E-06	2.5E+00	7.1	5.8	0.0105	3650	1.3E-05
	24000	0.0002	3.3E-05	3.4E-03	1.9E-06	2.5E+00	7.1	5.8	0.0105	3650	5.2E-06
	40000	0.0001	3.3E-05	3.4E-03	9.7E-07	2.5E+00	7.1	5.8	0.0105	3650	2.6E-06

	Distance (m)	Fog Oil Concentration (g/m²)	Skin Surface Area (m²)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging Dermal Absorption									
	3500	0.01	0.026	1	7.1	5.8	0.0105	3650	2.8E-04
	4000	0.005	0.026	1	7.1	5.8	0.0105	3650	1.4E-04
	5500	0.002	0.026	1	7.1	5.8	0.0105	3650	5.6E-05
	8000	0.001	0.026	1	7.1	5.8	0.0105	3650	2.8E-05
	12000	0.0005	0.026	1	7.1	5.8	0.0105	3650	1.4E-05
	24000	0.0002	0.026	1	7.1	5.8	0.0105	3650	5.6E-06
	40000	0.0001	0.026	1	7.1	5.8	0.0105	3650	2.8E-06

Gray bat intake for fog oil under Pasquill Category C.

	Distance (m)	Fog Oil Concentration (g/m³)	Intake Rate (m³) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Maternity Cave Inhalation										
Saltpeter #3	3682	0.002	3.4E-04	1.4E-05	1.0E-04	7.1	5.8	0.0105	3650	2.2E-07
Freeman	12547	0.001	3.4E-04	1.4E-05	0.0E+00	7.1	5.8	0.0105	3650	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m²)	Skin Surface Area (m²)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Maternity Cave Dermal Absorption									
Saltpeter #3	3682	0.005	0.026	1	7.1	5.8	0.0105	3650	1.4E-04
Freeman	12547	0.0002	0.026	1	7.1	5.8	0.0105	3650	5.6E-06

Gray bat intake for fog oil under Pasquill Category D.

Static Smoke	Distance (m)	Fog Oil Concentration (g/m³)	Intake Rate (m³) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging Inhalation										
	3500	0.01	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	2.3E-07
	4500	0.005	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	1.1E-07
	6500	0.002	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	4.5E-08
	8500	0.001	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	2.3E-08
	12500	0.0005	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	1.1E-08
	22500	0.0002	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	4.5E-09
	35500	0.0001	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	2.3E-09

	Distance (m)	Fog Oil Deposition (g/m²)	Prey SA (m²)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging Ingestion											
	6500	0.01	3.3E-05	3.4E-03	9.7E-05	2.5E+00	7.1	5.8	0.0105	3650	2.6E-04
	8500	0.005	3.3E-05	3.4E-03	4.9E-05	2.5E+00	7.1	5.8	0.0105	3650	1.3E-04
	14000	0.002	3.3E-05	3.4E-03	1.9E-05	2.5E+00	7.1	5.8	0.0105	3650	5.2E-05
	22000	0.001	3.3E-05	3.4E-03	9.7E-06	2.5E+00	7.1	5.8	0.0105	3650	2.6E-05
	35500	0.0005	3.3E-05	3.4E-03	4.9E-06	2.5E+00	7.1	5.8	0.0105	3650	1.3E-05
	50000+	0.0002	3.3E-05	3.4E-03	1.9E-06	2.5E+00	7.1	5.8	0.0105	3650	5.2E-06
	50000++	0.0001	3.3E-05	3.4E-03	9.7E-07	2.5E+00	7.1	5.8	0.0105	3650	2.6E-06

	Distance (m)	Fog Oil Concentration (g/m²)	Skin Surface Area (m²)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging Dermal Absorption									
	6500	0.01	0.026	1	7.1	5.8	0.0105	3650	2.8E-04
	8500	0.005	0.026	1	7.1	5.8	0.0105	3650	1.4E-04
	14000	0.002	0.026	1	7.1	5.8	0.0105	3650	5.6E-05
	22000	0.001	0.026	1	7.1	5.8	0.0105	3650	2.8E-05
	35500	0.0005	0.026	1	7.1	5.8	0.0105	3650	1.4E-05
	50000+	0.0002	0.026	1	7.1	5.8	0.0105	3650	5.6E-06
	50000++	0.0001	0.026	1	7.1	5.8	0.0105	3650	2.8E-06

Gray bat intake for fog oil under Pasquill Category D.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Maternity Cave Inhalation										
Saltpeter #3	3682	0.005	3.4E-04	1.4E-05	1.0E-04	7.1	5.8	0.0105	3650	5.4E-07
Freeman	12547	0.0005	3.4E-04	1.4E-05	0.0E+00	7.1	5.8	0.0105	3650	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Maternity Cave Dermal Absorption									
Saltpeter #3	3682	0.01	0.026	1	7.1	5.8	0.0105	3650	2.8E-04
Freeman	12547	0.002	0.026	1	7.1	5.8	0.0105	3650	5.6E-05

Gray bat intake for fog oil under Pasquill Category E.

Static Smoke	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging Inhalation										
	4000	0.01	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	2.3E-07
	5000	0.005	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	1.1E-07
	9000	0.002	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	4.5E-08
	14000	0.001	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	2.3E-08
	24000	0.0005	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	1.1E-08
	50000	0.0002	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	4.5E-09
	50000+	0.0001	3.4E-04	1.4E-05	2.1E-05	7.1	5.8	0.0105	3650	2.3E-09

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging Ingestion											
	7500	0.01	3.3E-05	3.4E-03	9.7E-05	2.5E+00	7.1	5.8	0.0105	3650	2.6E-04
	10000	0.005	3.3E-05	3.4E-03	4.9E-05	2.5E+00	7.1	5.8	0.0105	3650	1.3E-04
	18000	0.002	3.3E-05	3.4E-03	1.9E-05	2.5E+00	7.1	5.8	0.0105	3650	5.2E-05
	30000	0.001	3.3E-05	3.4E-03	9.7E-06	2.5E+00	7.1	5.8	0.0105	3650	2.6E-05
	50000	0.0005	3.3E-05	3.4E-03	4.9E-06	2.5E+00	7.1	5.8	0.0105	3650	1.3E-05
	50000+	0.0002	3.3E-05	3.4E-03	1.9E-06	2.5E+00	7.1	5.8	0.0105	3650	5.2E-06
	50000++	0.0001	3.3E-05	3.4E-03	9.7E-07	2.5E+00	7.1	5.8	0.0105	3650	2.6E-06

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging Dermal Absorption									
	7500	0.01	0.026	1	7.1	5.8	0.0105	3650	2.8E-04
	10000	0.005	0.026	1	7.1	5.8	0.0105	3650	1.4E-04
	18000	0.002	0.026	1	7.1	5.8	0.0105	3650	5.6E-05
	30000	0.001	0.026	1	7.1	5.8	0.0105	3650	2.8E-05
	50000	0.0005	0.026	1	7.1	5.8	0.0105	3650	1.4E-05
	50000+	0.0002	0.026	1	7.1	5.8	0.0105	3650	5.6E-06
	50000++	0.0001	0.026	1	7.1	5.8	0.0105	3650	2.8E-06

Gray bat intake for fog oil under Pasquill Category E.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Maternity Cave Inhalation										
Saltpeter #3	3682	0.01	3.4E-04	1.4E-05	1.0E-04	7.1	5.8	0.0105	3650	1.1E-06
Freeman	12547	0.001	3.4E-04	1.4E-05	0.0E+00	7.1	5.8	0.0105	3650	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Maternity Cave Dermal Absorption									
Saltpeter #3	3682	0.01	0.026	1	7.1	5.8	0.0105	3650	2.8E-04
Freeman	12547	0.002	0.026	1	7.1	5.8	0.0105	3650	5.6E-05

Attachment D: Fog Oil - Mobile Smoke

Gray bat intake for fog oil under Pasquill Category B.

Mobile Smoke										
	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging Inhalation										
	4000	0.01	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	1.3E-06
	4000	0.005	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	6.7E-07
	4000	0.002	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	2.7E-07
	5000	0.001	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	1.3E-07
	5000	0.0005	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	6.7E-08
	7000	0.0002	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	2.7E-08
	9000	0.0001	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	1.3E-08

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day) Daily IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging Ingestion											
	4000	0.01	3.3E-05	3.4E-03	9.7E-05	2.5E-03	25.3	5.8	0.0105	3650	9.3E-07
	5000	0.005	3.3E-05	3.4E-03	4.9E-05	2.5E-03	25.3	5.8	0.0105	3650	4.7E-07
	6000	0.002	3.3E-05	3.4E-03	1.9E-05	2.5E-03	25.3	5.8	0.0105	3650	1.9E-07
	7500	0.001	3.3E-05	3.4E-03	9.7E-06	2.5E-03	25.3	5.8	0.0105	3650	9.3E-08
	9500	0.0005	3.3E-05	3.4E-03	4.9E-06	2.5E-03	25.3	5.8	0.0105	3650	4.7E-08
	14500	0.0002	3.3E-05	3.4E-03	1.9E-06	2.5E-03	25.3	5.8	0.0105	3650	1.9E-08
	8500	0.0001	3.3E-05	3.4E-03	9.7E-07	2.5E-03	25.3	5.8	0.0105	3650	9.3E-09

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging Dermal Absorption									
	4000	0.01	0.026	1	25.3	5.8	0.0105	3650	1.0E-03
	5000	0.005	0.026	1	25.3	5.8	0.0105	3650	5.0E-04
	6000	0.002	0.026	1	25.3	5.8	0.0105	3650	2.0E-04
	7500	0.001	0.026	1	25.3	5.8	0.0105	3650	1.0E-04
	9500	0.0005	0.026	1	25.3	5.8	0.0105	3650	5.0E-05
	14500	0.0002	0.026	1	25.3	5.8	0.0105	3650	2.0E-05
	8500	0.0001	0.026	1	25.3	5.8	0.0105	3650	1.0E-05

Gray bat intake for fog oil under Pasquill Category B.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Maternity Cave Inhalation										
Musgrave Hollow										
Saltpeter #3	5447	0.001	3.4E-04	1.4E-05	8.3E-05	25.3	5.8	0.0105	3650	3.2E-07
Freeman	13104	0	3.4E-04	1.4E-05	0.0E+00	25.3	5.8	0.0105	3650	0.0E+00
Baily McCann Hollow										
Saltpeter #3	2004	0.01	3.4E-04	1.4E-05	1.0E-04	19.0	5.8	0.0105	3650	3.0E-06
Freeman	12024	0	3.4E-04	1.4E-05	0.0E+00	19.0	5.8	0.0105	3650	0.0E+00
Mush Paddle Hollow										
Saltpeter #3	1751	0.01	3.4E-04	1.4E-05	1.0E-04	15.8	5.8	0.0105	3650	2.5E-06
Freeman	16542	0	3.4E-04	1.4E-05	0.0E+00	15.8	5.8	0.0105	3650	0.0E+00
Ballard Hollow										
Saltpeter #3	13821	0	3.4E-04	1.4E-05	0.0E+00	12.7	5.8	0.0105	3650	0.0E+00
Freeman	11266	0	3.4E-04	1.4E-05	0.0E+00	12.7	5.8	0.0105	3650	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Maternity Cave Dermal Absorption									
Musgrave Hollow									
Saltpeter #3	5447	0.002	0.026	1	25.3	5.8	0.0105	3650	2.0E-04
Freeman	13104	0.0002	0.026	1	25.3	5.8	0.0105	3650	2.0E-05
Baily McCann Hollow									
Saltpeter #3	2004	0.01	0.026	1	19.0	5.8	0.0105	3650	7.5E-04
Freeman	12024	0.0002	0.026	1	19.0	5.8	0.0105	3650	1.5E-05
Mush Paddle Hollow									
Saltpeter #3	1751	0.01	0.026	1	15.8	5.8	0.0105	3650	6.2E-04
Freeman	16542	0.0001	0.026	1	15.8	5.8	0.0105	3650	6.2E-06
Ballard Hollow									
Saltpeter #3	13821	0.0002	0.026	1	12.7	5.8	0.0105	3650	1.0E-05
Freeman	11266	0.0002	0.026	1	12.7	5.8	0.0105	3650	1.0E-05

Gray bat intake for fog oil under Pasquill Category C.

Mobile Smoke	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging Inhalation										
	3000	0.01	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	1.3E-06
	3000	0.005	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	6.7E-07
	3000	0.002	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	2.7E-07
	4500	0.001	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	1.3E-07
	6500	0.0005	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	6.7E-08
	9500	0.0002	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	2.7E-08
	14000	0.0001	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	1.3E-08

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day) Daily IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging Ingestion											
	3000	0.01	3.3E-05	3.4E-03	9.7E-05	2.5E-03	25.3	5.8	0.0105	3650	9.3E-07
	4000	0.005	3.3E-05	3.4E-03	4.9E-05	2.5E-03	25.3	5.8	0.0105	3650	4.7E-07
	5000	0.002	3.3E-05	3.4E-03	1.9E-05	2.5E-03	25.3	5.8	0.0105	3650	1.9E-07
	8500	0.001	3.3E-05	3.4E-03	9.7E-06	2.5E-03	25.3	5.8	0.0105	3650	9.3E-08
	12000	0.0005	3.3E-05	3.4E-03	4.9E-06	2.5E-03	25.3	5.8	0.0105	3650	4.7E-08
	24000	0.0002	3.3E-05	3.4E-03	1.9E-06	2.5E-03	25.3	5.8	0.0105	3650	1.9E-08
	40000	0.0001	3.3E-05	3.4E-03	9.7E-07	2.5E-03	25.3	5.8	0.0105	3650	9.3E-09

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging Dermal Absorption									
	3000	0.01	0.026	1	25.3	5.8	0.0105	3650	1.0E-03
	4000	0.005	0.026	1	25.3	5.8	0.0105	3650	5.0E-04
	5000	0.002	0.026	1	25.3	5.8	0.0105	3650	2.0E-04
	8500	0.001	0.026	1	25.3	5.8	0.0105	3650	1.0E-04
	12000	0.0005	0.026	1	25.3	5.8	0.0105	3650	5.0E-05
	24000	0.0002	0.026	1	25.3	5.8	0.0105	3650	2.0E-05
	40000	0.0001	0.026	1	25.3	5.8	0.0105	3650	1.0E-05

Gray bat intake for fog oil under Pasquill Category C.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Maternity Cave Inhalation										
Musgrave Hollow										
Saltpeter #3	5447	0.0005	3.4E-04	1.4E-05	8.3E-05	25.3	5.8	0.0105	3650	1.6E-07
Freeman	13104	0.0001	3.4E-04	1.4E-05	0.0E+00	25.3	5.8	0.0105	3650	0.0E+00
Bally McCann Hollow										
Saltpeter #3	2004	0.01	3.4E-04	1.4E-05	1.0E-04	19.0	5.8	0.0105	3650	3.0E-06
Freeman	12024	0.0001	3.4E-04	1.4E-05	0.0E+00	19.0	5.8	0.0105	3650	0.0E+00
Mush Paddle Hollow										
Saltpeter #3	1751	0.01	3.4E-04	1.4E-05	1.0E-04	15.8	5.8	0.0105	3650	2.5E-06
Freeman	16542	0.0001	3.4E-04	1.4E-05	0.0E+00	15.8	5.8	0.0105	3650	0.0E+00
Ballard Hollow										
Saltpeter #3	13821	0.0001	3.4E-04	1.4E-05	0.0E+00	12.7	5.8	0.0105	3650	0.0E+00
Freeman	11266	0.0001	3.4E-04	1.4E-05	0.0E+00	12.7	5.8	0.0105	3650	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Maternity Cave Dermal Absorption									
Musgrave Hollow									
Saltpeter #3	5447	0.001	0.026	1	25.3	5.8	0.0105	3650	1.0E-04
Freeman	13104	0.0002	0.026	1	25.3	5.8	0.0105	3650	2.0E-05
Bally McCann Hollow									
Saltpeter #3	2004	0.01	0.026	1	19.0	5.8	0.0105	3650	7.5E-04
Freeman	12024	0.0005	0.026	1	19.0	5.8	0.0105	3650	3.7E-05
Mush Paddle Hollow									
Saltpeter #3	1751	0.01	0.026	1	15.8	5.8	0.0105	3650	6.2E-04
Freeman	16542	0.0002	0.026	1	15.8	5.8	0.0105	3650	1.2E-05
Ballard Hollow									
Saltpeter #3	13821	0.0002	0.026	1	12.7	5.8	0.0105	3650	1.0E-05
Freeman	11266	0.0005	0.026	1	12.7	5.8	0.0105	3650	2.5E-05

Gray bat intake for fog oil under Pasquill Category D.

Mobile Smoke	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging Inhalation										
	2500	0.01	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	1.3E-06
	3000	0.005	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	6.7E-07
	4500	0.002	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	2.7E-07
	6000	0.001	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	1.3E-07
	9500	0.0005	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	6.7E-08
	16500	0.0002	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	2.7E-08
	26500	0.0001	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	1.3E-08

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
						Daily IR					
Summer Foraging Ingestion											
	6500	0.01	3.3E-05	3.4E-03	9.7E-05	2.5E-03	25.3	5.8	0.0105	3650	9.3E-07
	8500	0.005	3.3E-05	3.4E-03	4.9E-05	2.5E-03	25.3	5.8	0.0105	3650	4.7E-07
	14500	0.002	3.3E-05	3.4E-03	1.9E-05	2.5E-03	25.3	5.8	0.0105	3650	1.9E-07
	22000	0.001	3.3E-05	3.4E-03	9.7E-06	2.5E-03	25.3	5.8	0.0105	3650	9.3E-08
	35500	0.0005	3.3E-05	3.4E-03	4.9E-06	2.5E-03	25.3	5.8	0.0105	3650	4.7E-08
	50000+	0.0002	3.3E-05	3.4E-03	1.9E-06	2.5E-03	25.3	5.8	0.0105	3650	1.9E-08
	50000++	0.0001	3.3E-05	3.4E-03	9.7E-07	2.5E-03	25.3	5.8	0.0105	3650	9.3E-09

	Distance (m)	Fog Oil Concentration (g/m^3)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging Dermal Absorption									
	6500	0.01	0.026	1	25.3	5.8	0.0105	3650	1.0E-03
	8500	0.005	0.026	1	25.3	5.8	0.0105	3650	5.0E-04
	14500	0.002	0.026	1	25.3	5.8	0.0105	3650	2.0E-04
	22000	0.001	0.026	1	25.3	5.8	0.0105	3650	1.0E-04
	35500	0.0005	0.026	1	25.3	5.8	0.0105	3650	5.0E-05
	50000+	0.0002	0.026	1	25.3	5.8	0.0105	3650	2.0E-05
	50000++	0.0001	0.026	1	25.3	5.8	0.0105	3650	1.0E-05

Gray bat intake for fog oil under Pasquill Category D.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Maternity Cave Inhalation										
Musgrave Hollow										
Saltpeter #3	5447	0.001	3.4E-04	1.4E-05	8.3E-05	25.3	5.8	0.0105	3650	1.1E-10
Freeman	13104	0.0002	3.4E-04	1.4E-05	0.0E+00	25.3	5.8	0.0105	3650	0.0E+00
Bally McCann Hollow										
Saltpeter #3	2004	0.01	3.4E-04	1.4E-05	1.0E-04	19.0	5.8	0.0105	3650	1.0E-09
Freeman	12024	0.0002	3.4E-04	1.4E-05	0.0E+00	19.0	5.8	0.0105	3650	0.0E+00
Mush Paddle Hollow										
Saltpeter #3	1751	0.01	3.4E-04	1.4E-05	1.0E-04	15.8	5.8	0.0105	3650	8.4E-10
Freeman	16542	0.0002	3.4E-04	1.4E-05	0.0E+00	15.8	5.8	0.0105	3650	0.0E+00
Ballard Hollow										
Saltpeter #3	13821	0.0002	3.4E-04	1.4E-05	0.0E+00	12.7	5.8	0.0105	3650	0.0E+00
Freeman	11266	0.0002	3.4E-04	1.4E-05	0.0E+00	12.7	5.8	0.0105	3650	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Maternity Cave Dermal Absorption									
Musgrave Hollow									
Saltpeter #3	5447	0.01	0.026	1	25.3	5.8	0.0105	3650	1.0E-03
Freeman	13104	0.002	0.026	1	25.3	5.8	0.0105	3650	2.0E-04
Bally McCann Hollow									
Saltpeter #3	2004	0.01	0.026	1	19.0	5.8	0.0105	3650	7.5E-04
Freeman	12024	0.002	0.026	1	19.0	5.8	0.0105	3650	1.5E-04
Mush Paddle Hollow									
Saltpeter #3	1751	0.01	0.026	1	15.8	5.8	0.0105	3650	6.2E-04
Freeman	16542	0.001	0.026	1	15.8	5.8	0.0105	3650	6.2E-05
Ballard Hollow									
Saltpeter #3	13821	0.002	0.026	1	12.7	5.8	0.0105	3650	1.0E-04
Freeman	11266	0.002	0.026	1	12.7	5.8	0.0105	3650	1.0E-04

Gray bat intake for fog oil under Pasquill Category E.

Mobile Smoke

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging Inhalation										
	3000	0.01	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	1.3E-06
	4000	0.005	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	6.7E-07
	7000	0.002	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	2.7E-07
	10000	0.001	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	1.3E-07
	16000	0.0005	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	6.7E-08
	30000	0.0002	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	2.7E-08
	50000	0.0001	3.4E-04	1.4E-05	3.5E-05	25.3	5.8	0.0105	3650	1.3E-08

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day) Daily IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Foraging Ingestion											
	7500	0.01	3.3E-05	3.4E-03	9.7E-05	2.5E-03	25.3	5.8	0.0105	3650	9.3E-07
	10000	0.005	3.3E-05	3.4E-03	4.9E-05	2.5E-03	25.3	5.8	0.0105	3650	4.7E-07
	18000	0.002	3.3E-05	3.4E-03	1.9E-05	2.5E-03	25.3	5.8	0.0105	3650	1.9E-07
	30000	0.001	3.3E-05	3.4E-03	9.7E-06	2.5E-03	25.3	5.8	0.0105	3650	9.3E-08
	50000	0.0005	3.3E-05	3.4E-03	4.9E-06	2.5E-03	25.3	5.8	0.0105	3650	4.7E-08
	50000+	0.0002	3.3E-05	3.4E-03	1.9E-06	2.5E-03	25.3	5.8	0.0105	3650	1.9E-08
	50000++	0.0001	3.3E-05	3.4E-03	9.7E-07	2.5E-03	25.3	5.8	0.0105	3650	9.3E-09

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Foraging Dermal Absorption									
	7500	0.01	0.026	1	25.3	5.8	0.0105	3650	1.0E-03
	10000	0.005	0.026	1	25.3	5.8	0.0105	3650	5.0E-04
	18000	0.002	0.026	1	25.3	5.8	0.0105	3650	2.0E-04
	30000	0.001	0.026	1	25.3	5.8	0.0105	3650	1.0E-04
	50000	0.0005	0.026	1	25.3	5.8	0.0105	3650	5.0E-05
	50000+	0.0002	0.026	1	25.3	5.8	0.0105	3650	2.0E-05
	50000++	0.0001	0.026	1	25.3	5.8	0.0105	3650	1.0E-05

Gray bat intake for fog oil under Pasquill Category E.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Maternity Cave Inhalation										
Musgrave Hollow										
Saltpeter #3	5447	0.002	3.4E-04	1.4E-05	8.3E-05	25.3	5.8	0.0105	3650	2.1E-10
Freeman	13104	0.0005	3.4E-04	1.4E-05	0.0E+00	25.3	5.8	0.0105	3650	0.0E+00
Bally McCann Hollow										
Saltpeter #3	2004	0.01	3.4E-04	1.4E-05	1.0E-04	19.0	5.8	0.0105	3650	1.0E-09
Freeman	12024	0.0005	3.4E-04	1.4E-05	0.0E+00	19.0	5.8	0.0105	3650	0.0E+00
Mush Paddle Hollow										
Saltpeter #3	1751	0.01	3.4E-04	1.4E-05	1.0E-04	15.8	5.8	0.0105	3650	8.4E-10
Freeman	16542	0.0005	3.4E-04	1.4E-05	0.0E+00	15.8	5.8	0.0105	3650	0.0E+00
Ballard Hollow										
Saltpeter #3	13821	0.0005	3.4E-04	1.4E-05	0.0E+00	12.7	5.8	0.0105	3650	0.0E+00
Freeman	11266	0.0005	3.4E-04	1.4E-05	0.0E+00	12.7	5.8	0.0105	3650	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Maternity Cave Dermal Absorption									
Musgrave Hollow									
Saltpeter #3	5447	0.01	0.026	1	25.3	5.8	0.0105	3650	1.0E-03
Freeman	13104	0.002	0.026	1	25.3	5.8	0.0105	3650	2.0E-04
Bally McCann Hollow									
Saltpeter #3	2004	0.01	0.026	1	19.0	5.8	0.0105	3650	7.5E-04
Freeman	12024	0.002	0.026	1	19.0	5.8	0.0105	3650	1.5E-04
Mush Paddle Hollow									
Saltpeter #3	1751	0.01	0.026	1	15.8	5.8	0.0105	3650	6.2E-04
Freeman	16542	0.002	0.026	1	15.8	5.8	0.0105	3650	1.2E-04
Ballard Hollow									
Saltpeter #3	13821	0.002	0.026	1	12.7	5.8	0.0105	3650	1.0E-04
Freeman	11266	0.002	0.026	1	12.7	5.8	0.0105	3650	1.0E-04

Attachment D: Terephthalic Acid (TPA) Grenades

Gray bat intake for TPA under Pasquill Category B.

TPA Smoke Grenade										
	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	1568	5.8	0.0105	3650	1.3E-03
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	1568	5.8	0.0105	3650	7.0E-07
	4000	0.002	3.4E-04	1.4E-05	5.9E-07	1568	5.8	0.0105	3650	2.8E-07
	4000	0.001	3.4E-04	1.4E-05	5.9E-07	1568	5.8	0.0105	3650	1.4E-07
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	1568	5.8	0.0105	3650	7.0E-08
	5000	0.0002	3.4E-04	1.4E-05	5.9E-07	1568	5.8	0.0105	3650	2.8E-08
	6000	0.0001	3.4E-04	1.4E-05	5.9E-07	1568	5.8	0.0105	3650	1.4E-08

	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Maternity Cave Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	3136	5.8	0.0105	3650	2.5E-03
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	3136	5.8	0.0105	3650	1.4E-06
	4000	0.002	3.4E-04	1.4E-05	5.9E-07	3136	5.8	0.0105	3650	5.6E-07
	4000	0.001	3.4E-04	1.4E-05	5.9E-07	3136	5.8	0.0105	3650	2.8E-07
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	3136	5.8	0.0105	3650	1.4E-07
	5000	0.0002	3.4E-04	1.4E-05	5.9E-07	3136	5.8	0.0105	3650	5.6E-08
	6000	0.0001	3.4E-04	1.4E-05	5.9E-07	3136	5.8	0.0105	3650	2.8E-08

Attachment D: TPA Smoke Pots

Gray bat intake for TPA under Pasquill Category B.

TPA Smoke Pots										
	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	475	5.8	0.0105	3650	3.8E-04
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	475	5.8	0.0105	3650	2.1E-07
	5000	0.002	3.4E-04	1.4E-05	5.9E-07	475	5.8	0.0105	3650	8.5E-08
	5000	0.001	3.4E-04	1.4E-05	5.9E-07	475	5.8	0.0105	3650	4.2E-08
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	475	5.8	0.0105	3650	2.1E-08
	6000	0.0002	3.4E-04	1.4E-05	5.9E-07	475	5.8	0.0105	3650	8.5E-09
	7000	0.0001	3.4E-04	1.4E-05	5.9E-07	475	5.8	0.0105	3650	4.2E-09

	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Maternity Cave Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	950	5.8	0.0105	3650	7.6E-04
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	950	5.8	0.0105	3650	4.2E-07
	5000	0.002	3.4E-04	1.4E-05	5.9E-07	950	5.8	0.0105	3650	1.7E-07
	5000	0.001	3.4E-04	1.4E-05	5.9E-07	950	5.8	0.0105	3650	8.5E-08
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	950	5.8	0.0105	3650	4.2E-08
	6000	0.0002	3.4E-04	1.4E-05	5.9E-07	950	5.8	0.0105	3650	1.7E-08
	7000	0.0001	3.4E-04	1.4E-05	5.9E-07	950	5.8	0.0105	3650	8.5E-09

Attachment D: Titanium Dioxide Grenades

Attachment D: Fog Oil - Static Smoke

Gray bat intake for titanium dioxide under Pasquill Category E.

	Distance (m)	Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging Inhalation										
	100	0.01	3.4E-04	1.4E-05	5.9E-07	24	5.8	0.0105	3650	2.1E-08
	300	0.005	3.4E-04	1.4E-05	5.9E-07	24	5.8	0.0105	3650	1.1E-08
	500	0.002	3.4E-04	1.4E-05	5.9E-07	24	5.8	0.0105	3650	4.3E-09
	700	0.001	3.4E-04	1.4E-05	5.9E-07	24	5.8	0.0105	3650	2.1E-09
	1000	0.0005	3.4E-04	1.4E-05	5.9E-07	24	5.8	0.0105	3650	1.1E-09
	1400	0.0002	3.4E-04	1.4E-05	5.9E-07	24	5.8	0.0105	3650	4.3E-10
	1800	0.0001	3.4E-04	1.4E-05	5.9E-07	24	5.8	0.0105	3650	2.1E-10

	Distance (m)	Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Maternity Cave Inhalation										
	100	0.01	3.4E-04	1.4E-05	5.9E-07	48	5.8	0.0105	3650	4.3E-08
	300	0.005	3.4E-04	1.4E-05	5.9E-07	48	5.8	0.0105	3650	2.1E-08
	500	0.002	3.4E-04	1.4E-05	5.9E-07	48	5.8	0.0105	3650	8.6E-09
	700	0.001	3.4E-04	1.4E-05	5.9E-07	48	5.8	0.0105	3650	4.3E-09
	1000	0.0005	3.4E-04	1.4E-05	5.9E-07	48	5.8	0.0105	3650	2.1E-09
	1400	0.0002	3.4E-04	1.4E-05	5.9E-07	48	5.8	0.0105	3650	8.6E-10
	1800	0.0001	3.4E-04	1.4E-05	5.9E-07	48	5.8	0.0105	3650	4.3E-10

Attachment E
Stressor Intake - Bald Eagle

INTAKE PARAMETERS FOR BALD EAGLES

Winter Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Fog Oil Concentration		Exposure concentration.
Intake Rate		Amount of air inhaled.
Daily Intake Rate	Daily IR	Amount of air inhaled each day.
Hourly Intake Rate	Hourly IR	Amount of air inhaled each hour.
Event Intake Rate	Event IR	Amount of air inhaled during each chemical release.
Exposure Frequency	EF	Number of chemical exposures per year.
Exposure Duration	ED	Estimate of time receptor will potentially be exposed to chemical.
Body Weight	BW	Mass of adult receptor.
Averaging Time	AT	Lifespan of receptor.
Daily Chronic Intake Value		Amount of chemical stressor inhaled by receptor.

Winter Ingestion

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Fog Oil Deposition		Exposure concentration.
Prey Surface Area	Prey SA	Size of area of the body surface of prey that might be covered by fog oil particles.
Prey Weight		Mass of prey.
Concentration of Food Contaminant	CF	Quantity of contaminant deposited on food item.
Intake Rate		Amount of food ingested during each chemical release.
Exposure Frequency	EF	Number of chemical exposures per year.
Exposure Duration	ED	Estimate of time receptor will potentially be exposed to chemical.
Body Weight	BW	Mass of adult receptor.
Averaging Time	AT	Lifespan of receptor.
Daily Chronic Intake Value		Amount of chemical stressor ingested by receptor.

Winter Dermal Absorption

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Fog Oil Concentration		Exposure concentration.
Skin Surface Area		Surface area of receptor.
Absorption Factor	ABS	Degree of dermal absorption of stressor by receptor. Unitless - assumed to equal 1 (100% absorption).
Exposure Frequency	EF	Number of chemical exposures per year.
Exposure Duration	ED	Estimate of time receptor will potentially be exposed to chemical.
Body Weight	BW	Mass of adult receptor.
Averaging Time	AT	Lifespan of receptor.
Dermally Absorbe Dose		Amount of chemical stressor dermally absorbed by receptor.

Summer Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Fog Oil Concentration		Exposure concentration.
Intake Rate		Amount of air inhaled.
Daily Intake Rate	Daily IR	Amount of air inhaled each day.
Hourly Intake Rate	Hourly IR	Amount of air inhaled each hour.
Event Intake Rate	Event IR	Amount of air inhaled during each chemical release.
Exposure Frequency	EF	Number of chemical exposures per year.
Exposure Duration	ED	Estimate of time receptor will potentially be exposed to chemical.
Body Weight	BW	Mass of adult receptor.
Averaging Time	AT	Lifespan of receptor.
Daily Chronic Intake Value		Amount of chemical stressor inhaled by receptor.

Summer Dermal Absorption

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Fog Oil Concentration		Exposure concentration.
Skin Surface Area		Surface area of receptor.
Absorption Factor	ABS	Degree of dermal absorption of stressor by receptor. Unitless - assumed to equal 1 (100% absorption).
Exposure Frequency	EF	Number of chemical exposures per year.
Exposure Duration	ED	Estimate of time receptor will potentially be exposed to chemical.
Body Weight	BW	Mass of adult receptor.
Averaging Time	AT	Lifespan of receptor.
Dermally Absorbed Dose		Amount of chemical stressor dermally absorbed by receptor.

Attachment E: Fog Oil - Static Smoke

Bald eagle intake for fog oil under Pasquill Category E.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Inhalation										
South Nest	20229	0.0005	1.31	0.055	0.082	7.1	20.42	4.5	12775	1.0E-07
Mid Nest	23638	0.0005	1.31	0.055	0.082	7.1	20.42	4.5	12775	1.0E-07
North Nest	45057	0.0002	1.31	0.055	0.082	7.1	20.42	4.5	12775	4.1E-08

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Dermal Absorption									
South Nest	20229	0.001	0.275	1	7.1	20.42	4.5	12775	6.9E-07
Mid Nest	23638	0.001	0.275	1	7.1	20.42	4.5	12775	6.9E-07
North Nest	45057	0.0005	0.275	1	7.1	20.42	4.5	12775	3.5E-07

Bald eagle intake for fog oil under Pasquill Category E.

Static Smoke

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Inhalation										
	4000	0.01	1.31	0.055	0.082	7.1	14.58	4.5	12775	1.5E-06
	5000	0.005	1.31	0.055	0.082	7.1	14.58	4.5	12775	7.4E-07
	9000	0.002	1.31	0.055	0.082	7.1	14.58	4.5	12775	2.9E-07
	14000	0.001	1.31	0.055	0.082	7.1	14.58	4.5	12775	1.5E-07
	24000	0.0005	1.31	0.055	0.082	7.1	14.58	4.5	12775	7.4E-08
	50000	0.0002	1.31	0.055	0.082	7.1	14.58	4.5	12775	2.9E-08
	50000+	0.0001	1.31	0.055	0.082	7.1	14.58	4.5	12775	1.5E-08

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Ingestion											
	7500	0.01	0.0874	0.815	0.0011	292.5	7.1	14.58	4.5	12775	5.6E-04
	10000	0.005	0.0874	0.815	0.0005	293.5	7.1	14.58	4.5	12775	2.8E-04
	18000	0.002	0.0874	0.815	0.0002	294.5	7.1	14.58	4.5	12775	1.1E-04
	30000	0.001	0.0874	0.815	0.0001	295.5	7.1	14.58	4.5	12775	5.7E-05
	50000	0.0005	0.0874	0.815	0.0001	296.5	7.1	14.58	4.5	12775	2.9E-05
	50000+	0.0002	0.0874	0.815	0.0000	297.5	7.1	14.58	4.5	12775	1.1E-05
	50000++	0.0001	0.0874	0.815	0.0000	298.5	7.1	14.58	4.5	12775	5.8E-06

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Dermal Absorption									
	7500	0.01	0.275	1	7.1	14.58	4.5	12775	4.9E-06
	10000	0.005	0.275	1	7.1	14.58	4.5	12775	2.5E-06
	18000	0.002	0.275	1	7.1	14.58	4.5	12775	9.9E-07
	30000	0.001	0.275	1	7.1	14.58	4.5	12775	4.9E-07
	50000	0.0005	0.275	1	7.1	14.58	4.5	12775	2.5E-07
	50000+	0.0002	0.275	1	7.1	14.58	4.5	12775	9.9E-08
	50000++	0.0001	0.275	1	7.1	14.58	4.5	12775	4.9E-08

Bald eagle intake for fog oil under Pasquill Category D.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Inhalation										
South Nest	20229	0.0002	1.31	0.055	0.082	7.1	20.42	4.5	12775	4.1E-08
Mid Nest	23638	0.0001	1.31	0.055	0.082	7.1	20.42	4.5	12775	2.1E-08
North Nest	45057	0	1.31	0.055	0.082	7.1	20.42	4.5	12775	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Dermal Absorption									
South Nest	20229	0.001	0.275	1	7.1	20.42	4.5	12775	6.9E-07
Mid Nest	23638	0.0005	0.275	1	7.1	20.42	4.5	12775	3.5E-07
North Nest	45057	0.0002	0.275	1	7.1	20.42	4.5	12775	1.4E-07

Bald eagle intake for fog oil under Pasquill Category D.

Static Smoke

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Inhalation										
	3500	0.01	1.31	0.055	0.082	7.1	14.58	4.5	12775	1.5E-06
	4500	0.005	1.31	0.055	0.082	7.1	14.58	4.5	12775	7.4E-07
	6500	0.002	1.31	0.055	0.082	7.1	14.58	4.5	12775	2.9E-07
	8500	0.001	1.31	0.055	0.082	7.1	14.58	4.5	12775	1.5E-07
	12500	0.0005	1.31	0.055	0.082	7.1	14.58	4.5	12775	7.4E-08
	22500	0.0002	1.31	0.055	0.082	7.1	14.58	4.5	12775	2.9E-08
	35500	0.0001	1.31	0.055	0.082	7.1	14.58	4.5	12775	1.5E-08

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Ingestion											
	6500	0.01	0.0874	0.815	0.0011	292.5	7.1	14.58	4.5	12775	5.6E-04
	8500	0.005	0.0874	0.815	0.0005	293.5	7.1	14.58	4.5	12775	2.8E-04
	14000	0.002	0.0874	0.815	0.0002	294.5	7.1	14.58	4.5	12775	1.1E-04
	22000	0.001	0.0874	0.815	0.0001	295.5	7.1	14.58	4.5	12775	5.7E-05
	35500	0.0005	0.0874	0.815	0.0001	296.5	7.1	14.58	4.5	12775	2.9E-05
	50000+	0.0002	0.0874	0.815	0.0000	297.5	7.1	14.58	4.5	12775	1.1E-05
	50000++	0.0001	0.0874	0.815	0.0000	298.5	7.1	14.58	4.5	12775	5.8E-06

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Dermal Absorption									
	6500	0.01	0.275	1	7.1	14.58	4.5	12775	4.9E-06
	8500	0.005	0.275	1	7.1	14.58	4.5	12775	2.5E-06
	14000	0.002	0.275	1	7.1	14.58	4.5	12775	9.9E-07
	22000	0.001	0.275	1	7.1	14.58	4.5	12775	4.9E-07
	35500	0.0005	0.275	1	7.1	14.58	4.5	12775	2.5E-07
	50000+	0.0002	0.275	1	7.1	14.58	4.5	12775	9.9E-08
	50000++	0.0001	0.275	1	7.1	14.58	4.5	12775	4.9E-08

Bald eagle intake for fog oil under Pasquill Category C.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Inhalation										
South Nest	20229	0	1.31	0.055	0.082	7.1	20.42	4.5	12775	0.0E+00
Mid Nest	23638	0	1.31	0.055	0.082	7.1	20.42	4.5	12775	0.0E+00
North Nest	45057	0	1.31	0.055	0.082	7.1	20.42	4.5	12775	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Dermal Absorption									
South Nest	20229	0.0002	0.275	1	7.1	20.42	4.5	12775	1.4E-07
Mid Nest	23638	0.0002	0.275	1	7.1	20.42	4.5	12775	1.4E-07
North Nest	45057	0	0.275	1	7.1	20.42	4.5	12775	0.0E+00

Bald eagle intake for fog oil under Pasquill Category C.

Static Smoke

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Inhalation										
	3500	0.01	1.31	0.055	0.082	7.1	14.58	4.5	12775	1.5E-06
	3500	0.005	1.31	0.055	0.082	7.1	14.58	4.5	12775	7.4E-07
	4000	0.002	1.31	0.055	0.082	7.1	14.58	4.5	12775	2.9E-07
	5500	0.001	1.31	0.055	0.082	7.1	14.58	4.5	12775	1.5E-07
	7500	0.0005	1.31	0.055	0.082	7.1	14.58	4.5	12775	7.4E-08
	12000	0.0002	1.31	0.055	0.082	7.1	14.58	4.5	12775	2.9E-08
	18500	0.0001	1.31	0.055	0.082	7.1	14.58	4.5	12775	1.5E-08

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Ingestion											
	3500	0.01	0.0874	0.815	0.0011	292.5	7.1	14.58	4.5	12775	5.6E-04
	4000	0.005	0.0874	0.815	0.0005	293.5	7.1	14.58	4.5	12775	2.8E-04
	5500	0.002	0.0874	0.815	0.0002	294.5	7.1	14.58	4.5	12775	1.1E-04
	8000	0.001	0.0874	0.815	0.0001	295.5	7.1	14.58	4.5	12775	5.7E-05
	12000	0.0005	0.0874	0.815	0.0001	296.5	7.1	14.58	4.5	12775	2.9E-05
	24000	0.0002	0.0874	0.815	0.0000	297.5	7.1	14.58	4.5	12775	1.1E-05
	40000	0.0001	0.0874	0.815	0.0000	298.5	7.1	14.58	4.5	12775	5.8E-06

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Dermal Absorption									
	3500	0.01	0.275	1	7.1	14.58	4.5	12775	4.9E-06
	4000	0.005	0.275	1	7.1	14.58	4.5	12775	2.5E-06
	5500	0.002	0.275	1	7.1	14.58	4.5	12775	9.9E-07
	8000	0.001	0.275	1	7.1	14.58	4.5	12775	4.9E-07
	12000	0.0005	0.275	1	7.1	14.58	4.5	12775	2.5E-07
	24000	0.0002	0.275	1	7.1	14.58	4.5	12775	9.9E-08
	40000	0.0001	0.275	1	7.1	14.58	4.5	12775	4.9E-08

Attachment E: Fog Oil - Mobile Smoke

Bald eagle intake for fog oil under Pasquill Category B.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Inhalation										
South Nest	20229	0	1.31	0.055	0.082	7.1	20.42	4.5	12775	0.0E+00
Mid Nest	23638	0	1.31	0.055	0.082	7.1	20.42	4.5	12775	0.0E+00
North Nest	45057	0	1.31	0.055	0.082	7.1	20.42	4.5	12775	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Dermal Absorption									
South Nest	20229	0.0001	0.275	1	7.1	20.42	4.5	12775	6.9E-08
Mid Nest	23638	0	0.275	1	7.1	20.42	4.5	12775	0.0E+00
North Nest	45057	0	0.275	1	7.1	20.42	4.5	12775	0.0E+00

Bald eagle intake for fog oil under Pasquill Category B.

Static Smoke

	Distance (m)	Fog Oil Concentration (g/m³)	Intake Rate (m³/day) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Inhalation										
	4000	0.01	1.31	0.055	0.082	7.1	14.58	4.5	12775	1.5E-06
	4000	0.005	1.31	0.055	0.082	7.1	14.58	4.5	12775	7.4E-07
	5000	0.002	1.31	0.055	0.082	7.1	14.58	4.5	12775	2.9E-07
	5000	0.001	1.31	0.055	0.082	7.1	14.58	4.5	12775	1.5E-07
	6000	0.0005	1.31	0.055	0.082	7.1	14.58	4.5	12775	7.4E-08
	8000	0.0002	1.31	0.055	0.082	7.1	14.58	4.5	12775	2.9E-08
	12000	0.0001	1.31	0.055	0.082	7.1	14.58	4.5	12775	1.5E-08

	Distance (m)	Fog Oil Deposition (g/m²)	Prey SA (m²)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Ingestion											
	4000	0.01	0.0874	0.815	0.0011	292.5	7.1	14.58	4.5	12775	5.6E-04
	5000	0.005	0.0874	0.815	0.0005	293.5	7.1	14.58	4.5	12775	2.8E-04
	6000	0.002	0.0874	0.815	0.0002	294.5	7.1	14.58	4.5	12775	1.1E-04
	7000	0.001	0.0874	0.815	0.0001	295.5	7.1	14.58	4.5	12775	5.7E-05
	9500	0.0005	0.0874	0.815	0.0001	296.5	7.1	14.58	4.5	12775	2.9E-05
	14000	0.0002	0.0874	0.815	0.0000	297.5	7.1	14.58	4.5	12775	1.1E-05
	20000	0.0001	0.0874	0.815	0.0000	298.5	7.1	14.58	4.5	12775	5.8E-06

	Distance (m)	Fog Oil Concentration (g/m²)	Skin Surface Area (m²)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Dermal Absorption									
	4000	0.01	0.275	1	7.1	14.58	4.5	12775	4.9E-06
	5000	0.005	0.275	1	7.1	14.58	4.5	12775	2.5E-06
	6000	0.002	0.275	1	7.1	14.58	4.5	12775	9.9E-07
	7000	0.001	0.275	1	7.1	14.58	4.5	12775	4.9E-07
	9500	0.0005	0.275	1	7.1	14.58	4.5	12775	2.5E-07
	14000	0.0002	0.275	1	7.1	14.58	4.5	12775	9.9E-08
	20000	0.0001	0.275	1	7.1	14.58	4.5	12775	4.9E-08

Bald eagle intake for fog oil under Pasquill Category B.

Mobile Smoke										
	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Winter Inhalation										
	4000	0.01	1.31	0.055	0.136	25.3	14.58	4.5	12775	8.8E-06
	4000	0.005	1.31	0.055	0.136	25.3	14.58	4.5	12775	4.4E-06
	4000	0.002	1.31	0.055	0.136	25.3	14.58	4.5	12775	1.8E-06
	5000	0.001	1.31	0.055	0.136	25.3	14.58	4.5	12775	8.8E-07
	5000	0.0005	1.31	0.055	0.136	25.3	14.58	4.5	12775	4.4E-07
	7000	0.0002	1.31	0.055	0.136	25.3	14.58	4.5	12775	1.8E-07
	9000	0.0001	1.31	0.055	0.136	25.3	14.58	4.5	12775	8.8E-08

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
						Daily IR					
Winter Ingestion											
	4000	0.01	0.0874	0.815	0.0011	292.5	25.3	14.58	4.5	12775	2.0E-03
	5000	0.005	0.0874	0.815	0.0005	293.5	25.3	14.58	4.5	12775	1.0E-03
	6000	0.002	0.0874	0.815	0.0002	294.5	25.3	14.58	4.5	12775	4.1E-04
	7500	0.001	0.0874	0.815	0.0001	295.5	25.3	14.58	4.5	12775	2.0E-04
	9500	0.0005	0.0874	0.815	0.0001	296.5	25.3	14.58	4.5	12775	1.0E-04
	14500	0.0002	0.0874	0.815	0.0000	297.5	25.3	14.58	4.5	12775	4.1E-05
	20000	0.0001	0.0874	0.815	0.0000	298.5	25.3	14.58	4.5	12775	2.1E-05

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Dermal Absorption									
	4000	0.01	0.275	1	25.3	14.58	4.5	12775	1.8E-05
	5000	0.005	0.275	1	25.3	14.58	4.5	12775	8.8E-06
	6000	0.002	0.275	1	25.3	14.58	4.5	12775	3.5E-06
	7500	0.001	0.275	1	25.3	14.58	4.5	12775	1.8E-06
	9500	0.0005	0.275	1	25.3	14.58	4.5	12775	8.8E-07
	14500	0.0002	0.275	1	25.3	14.58	4.5	12775	3.5E-07
	20000	0.0001	0.275	1	25.3	14.58	4.5	12775	1.8E-07

Bald eagle intake for fog oil under Pasquill Category B.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Summer Inhalation										
Musgrave Hollow										
South Nest	25174	0	1.31	0.055	0.136	25.3	20.42	4.5	12775	0.0E+00
Mid Nest	27956	0	1.31	0.055	0.136	25.3	20.42	4.5	12775	0.0E+00
North Nest	48211	0	1.31	0.055	0.136	25.3	20.42	4.5	12775	0.0E+00
Bally McCann Hollow										
South Nest	19717	0	1.31	0.055	0.136	19.0	20.42	4.5	12775	0.0E+00
Mid Nest	23623	0	1.31	0.055	0.136	19.0	20.42	4.5	12775	0.0E+00
North Nest	44956	0	1.31	0.055	0.136	19.0	20.42	4.5	12775	0.0E+00
Mush Paddle Hollow										
South Nest	20749	0	1.31	0.055	0.136	15.8	20.42	4.5	12775	0.0E+00
Mid Nest	28050	0	1.31	0.055	0.136	15.8	20.42	4.5	12775	0.0E+00
North Nest	49712	0	1.31	0.055	0.136	15.8	20.42	4.5	12775	0.0E+00
Ballard Hollow										
South Nest	17463	0	1.31	0.055	0.136	12.7	20.42	4.5	12775	0.0E+00
Mid Nest	11677	0	1.31	0.055	0.136	12.7	20.42	4.5	12775	0.0E+00
North Nest	34057	0	1.31	0.055	0.136	12.7	20.42	4.5	12775	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Dermal Absorption									
Musgrave Hollow									
South Nest	25174	0	0.275	1	25.3	20.42	4.5	12775	0.0E+00
Mid Nest	27956	0	0.275	1	25.3	20.42	4.5	12775	0.0E+00
North Nest	48211	0	0.275	1	25.3	20.42	4.5	12775	0.0E+00
Bally McCann Hollow									
South Nest	19717	0.0001	0.275	1	19.0	20.42	4.5	12775	1.9E-07
Mid Nest	23623	0	0.275	1	19.0	20.42	4.5	12775	0.0E+00
North Nest	44956	0	0.275	1	19.0	20.42	4.5	12775	0.0E+00
Mush Paddle Hollow									
South Nest	20749	0	0.275	1	15.8	20.42	4.5	12775	0.0E+00
Mid Nest	28050	0	0.275	1	15.8	20.42	4.5	12775	0.0E+00
North Nest	49712	0	0.275	1	15.8	20.42	4.5	12775	0.0E+00
Ballard Hollow									
South Nest	17463	0.0001	0.275	1	12.7	20.42	4.5	12775	1.2E-07
Mid Nest	11677	0.0002	0.275	1	12.7	20.42	4.5	12775	2.5E-07
North Nest	34057	0	0.275	1	12.7	20.42	4.5	12775	0.0E+00

Bald eagle intake for fog oil under Pasquill Category C.

Mobile Smoke	Distance (m)	Fog Oil Concentration (g/m³)	Intake Rate (m³/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Winter Inhalation										
	3000	0.01	1.31	0.055	0.136	25.3	14.58	4.5	12775	8.8E-06
	3000	0.005	1.31	0.055	0.136	25.3	14.58	4.5	12775	4.4E-06
	3000	0.002	1.31	0.055	0.136	25.3	14.58	4.5	12775	1.8E-06
	4500	0.001	1.31	0.055	0.136	25.3	14.58	4.5	12775	8.8E-07
	6500	0.0005	1.31	0.055	0.136	25.3	14.58	4.5	12775	4.4E-07
	9500	0.0002	1.31	0.055	0.136	25.3	14.58	4.5	12775	1.8E-07
	14000	0.0001	1.31	0.055	0.136	25.3	14.58	4.5	12775	8.8E-08

	Distance (m)	Fog Oil Deposition (g/m²)	Prey SA (m²)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
						Daily IR					
Winter Ingestion											
	3000	0.01	0.0874	0.815	0.0011	292.5	25.3	14.58	4.5	12775	2.0E-03
	4000	0.005	0.0874	0.815	0.0005	293.5	25.3	14.58	4.5	12775	1.0E-03
	5000	0.002	0.0874	0.815	0.0002	294.5	25.3	14.58	4.5	12775	4.1E-04
	8500	0.001	0.0874	0.815	0.0001	295.5	25.3	14.58	4.5	12775	2.0E-04
	12000	0.0005	0.0874	0.815	0.0001	296.5	25.3	14.58	4.5	12775	1.0E-04
	24000	0.0002	0.0874	0.815	0.0000	297.5	25.3	14.58	4.5	12775	4.1E-05
	40000	0.0001	0.0874	0.815	0.0000	298.5	25.3	14.58	4.5	12775	2.1E-05

	Distance (m)	Fog Oil Concentration (g/m²)	Skin Surface Area (m²)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Dermal Absorption									
	3000	0.01	0.275	1	25.3	14.58	4.5	12775	1.8E-05
	4000	0.005	0.275	1	25.3	14.58	4.5	12775	8.8E-06
	5000	0.002	0.275	1	25.3	14.58	4.5	12775	3.5E-06
	8500	0.001	0.275	1	25.3	14.58	4.5	12775	1.8E-06
	12000	0.0005	0.275	1	25.3	14.58	4.5	12775	8.8E-07
	24000	0.0002	0.275	1	25.3	14.58	4.5	12775	3.5E-07
	40000	0.0001	0.275	1	25.3	14.58	4.5	12775	1.8E-07

Bald eagle intake for fog oil under Pasquill Category C.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Inhalation										
Musgrave Hollow										
South Nest	25174	0	1.31	0.055	0.136	25.3	20.42	4.5	12775	0.0E+00
Mid Nest	27956	0	1.31	0.055	0.136	25.3	20.42	4.5	12775	0.0E+00
North Nest	48211	0	1.31	0.055	0.136	25.3	20.42	4.5	12775	0.0E+00
Bally McCann Hollow										
South Nest	19717	0	1.31	0.055	0.136	19.0	20.42	4.5	12775	0.0E+00
Mid Nest	23623	0	1.31	0.055	0.136	19.0	20.42	4.5	12775	0.0E+00
North Nest	44956	0	1.31	0.055	0.136	19.0	20.42	4.5	12775	0.0E+00
Mush Paddle Hollow										
South Nest	20749	0	1.31	0.055	0.136	15.8	20.42	4.5	12775	0.0E+00
Mid Nest	28050	0	1.31	0.055	0.136	15.8	20.42	4.5	12775	0.0E+00
North Nest	49712	0	1.31	0.055	0.136	15.8	20.42	4.5	12775	0.0E+00
Ballard Hollow										
South Nest	17463	0	1.31	0.055	0.136	12.7	20.42	4.5	12775	0.0E+00
Mid Nest	11677	0.0001	1.31	0.055	0.136	12.7	20.42	4.5	12775	6.1E-08
North Nest	34057	0	1.31	0.055	0.136	12.7	20.42	4.5	12775	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Dermal Absorption									
Musgrave Hollow									
South Nest	25174	0.0001	0.275	1	25.3	20.42	4.5	12775	2.5E-07
Mid Nest	27956	0.0001	0.275	1	25.3	20.42	4.5	12775	2.5E-07
North Nest	48211	0.0001	0.275	1	25.3	20.42	4.5	12775	2.5E-07
Baily McCann Hollow									
South Nest	19717	0.0002	0.275	1	19.0	20.42	4.5	12775	3.7E-07
Mid Nest	23623	0.0002	0.275	1	19.0	20.42	4.5	12775	3.7E-07
North Nest	44956	0	0.275	1	19.0	20.42	4.5	12775	0.0E+00
Mush Paddle Hollow									
South Nest	20749	0.0005	0.275	1	15.8	20.42	4.5	12775	7.7E-07
Mid Nest	28050	0.0001	0.275	1	15.8	20.42	4.5	12775	1.5E-07
North Nest	49712	0	0.275	1	15.8	20.42	4.5	12775	0.0E+00
Ballard Hollow									
South Nest	17463	0.0002	0.275	1	12.7	20.42	4.5	12775	2.5E-07
Mid Nest	11677	0.0005	0.275	1	12.7	20.42	4.5	12775	6.2E-07
North Nest	34057	0.0001	0.275	1	12.7	20.42	4.5	12775	1.2E-07

Bald eagle intake for fog oil under Pasquill Category D.

Mobile Smoke	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Inhalation										
	2500	0.01	1.31	0.055	0.136	25.3	14.58	4.5	12775	8.8E-06
	3000	0.005	1.31	0.055	0.136	25.3	14.58	4.5	12775	4.4E-06
	4500	0.002	1.31	0.055	0.136	25.3	14.58	4.5	12775	1.8E-06
	6000	0.001	1.31	0.055	0.136	25.3	14.58	4.5	12775	8.8E-07
	9500	0.0005	1.31	0.055	0.136	25.3	14.58	4.5	12775	4.4E-07
	16500	0.0002	1.31	0.055	0.136	25.3	14.58	4.5	12775	1.8E-07
	26500	0.0001	1.31	0.055	0.136	25.3	14.58	4.5	12775	8.8E-08

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day) Daily IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Ingestion											
	6500	0.01	0.0874	0.815	0.0011	292.5	25.3	14.58	4.5	12775	2.0E-03
	8500	0.005	0.0874	0.815	0.0005	293.5	25.3	14.58	4.5	12775	1.0E-03
	14500	0.002	0.0874	0.815	0.0002	294.5	25.3	14.58	4.5	12775	4.1E-04
	22000	0.001	0.0874	0.815	0.0001	295.5	25.3	14.58	4.5	12775	2.0E-04
	35500	0.0005	0.0874	0.815	0.0001	296.5	25.3	14.58	4.5	12775	1.0E-04
	50000+	0.0002	0.0874	0.815	0.0000	297.5	25.3	14.58	4.5	12775	4.1E-05
	50000++	0.0001	0.0874	0.815	0.0000	298.5	25.3	14.58	4.5	12775	2.1E-05

	Distance (m)	Fog Oil Concentration (g/m^3)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Dermal Absorption									
	6500	0.01	0.275	1	25.3	14.58	4.5	12775	1.8E-05
	8500	0.005	0.275	1	25.3	14.58	4.5	12775	8.8E-06
	14500	0.002	0.275	1	25.3	14.58	4.5	12775	3.5E-06
	22000	0.001	0.275	1	25.3	14.58	4.5	12775	1.8E-06
	35500	0.0005	0.275	1	25.3	14.58	4.5	12775	8.8E-07
	50000+	0.0002	0.275	1	25.3	14.58	4.5	12775	3.5E-07
	50000++	0.0001	0.275	1	25.3	14.58	4.5	12775	1.8E-07

Bald eagle intake for fog oil under Pasquill Category D.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Inhalation										
Musgrave Hollow										
South Nest	25174	0.0001	1.31	0.055	0.136	25.3	20.42	4.5	12775	1.2E-07
Mid Nest	27956	0	1.31	0.055	0.136	25.3	20.42	4.5	12775	0.0E+00
North Nest	48211	0	1.31	0.055	0.136	25.3	20.42	4.5	12775	0.0E+00
Bally McCann Hollow										
South Nest	19717	0.0001	1.31	0.055	0.136	19.0	20.42	4.5	12775	9.2E-08
Mid Nest	23623	0.0001	1.31	0.055	0.136	19.0	20.42	4.5	12775	9.2E-08
North Nest	44956	0	1.31	0.055	0.136	19.0	20.42	4.5	12775	0.0E+00
Mush Paddle Hollow										
South Nest	20749	0.0001	1.31	0.055	0.136	15.8	20.42	4.5	12775	7.7E-08
Mid Nest	28050	0	1.31	0.055	0.136	15.8	20.42	4.5	12775	0.0E+00
North Nest	49712	0	1.31	0.055	0.136	15.8	20.42	4.5	12775	0.0E+00
Ballard Hollow										
South Nest	17463	0.0001	1.31	0.055	0.136	12.7	20.42	4.5	12775	6.1E-08
Mid Nest	11677	0.0002	1.31	0.055	0.136	12.7	20.42	4.5	12775	1.2E-07
North Nest	34057	0	1.31	0.055	0.136	12.7	20.42	4.5	12775	0.0E+00

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Dermal Absorption									
Musgrave Hollow									
South Nest	25174	0.0005	0.275	1	25.3	20.42	4.5	12775	1.2E-06
Mid Nest	27956	0.0005	0.275	1	25.3	20.42	4.5	12775	1.2E-06
North Nest	48211	0.0002	0.275	1	25.3	20.42	4.5	12775	4.9E-07
Bally McCann Hollow									
South Nest	19717	0.001	0.275	1	19.0	20.42	4.5	12775	1.9E-06
Mid Nest	23623	0.0005	0.275	1	19.0	20.42	4.5	12775	9.3E-07
North Nest	44956	0.0002	0.275	1	19.0	20.42	4.5	12775	3.7E-07
Mush Paddle Hollow									
South Nest	20749	0.001	0.275	1	15.8	20.42	4.5	12775	1.5E-06
Mid Nest	28050	0.0005	0.275	1	15.8	20.42	4.5	12775	7.7E-07
North Nest	49712	0.0002	0.275	1	15.8	20.42	4.5	12775	3.1E-07
Ballard Hollow									
South Nest	17463	0.0001	0.275	1	12.7	20.42	4.5	12775	1.2E-07
Mid Nest	11677	0.002	0.275	1	12.7	20.42	4.5	12775	2.5E-06
North Nest	34057	0.0005	0.275	1	12.7	20.42	4.5	12775	6.2E-07

Bald eagle intake for fog oil under Pasquill Category E.

Mobile Smoke	Distance (m)	Fog Oil Concentration (g/m³)	Intake Rate (m^3/day) Daily IR	Hourly IR	Event IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Inhalation										
	3000	0.01	1.31	0.055	0.136	25.3	14.58	4.5	12775	8.8E-06
	4000	0.005	1.31	0.055	0.136	25.3	14.58	4.5	12775	4.4E-06
	7000	0.002	1.31	0.055	0.136	25.3	14.58	4.5	12775	1.8E-06
	10000	0.001	1.31	0.055	0.136	25.3	14.58	4.5	12775	8.8E-07
	16000	0.0005	1.31	0.055	0.136	25.3	14.58	4.5	12775	4.4E-07
	30000	0.0002	1.31	0.055	0.136	25.3	14.58	4.5	12775	1.8E-07
	50000	0.0001	1.31	0.055	0.136	25.3	14.58	4.5	12775	8.8E-08

	Distance (m)	Fog Oil Deposition (g/m²)	Prey SA (m²)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day) Daily IR	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Ingestion											
	7500	0.01	0.0874	0.815	0.0011	292.5	25.3	14.58	4.5	12775	2.0E-03
	10000	0.005	0.0874	0.815	0.0005	293.5	25.3	14.58	4.5	12775	1.0E-03
	18000	0.002	0.0874	0.815	0.0002	294.5	25.3	14.58	4.5	12775	4.1E-04
	30000	0.001	0.0874	0.815	0.0001	295.5	25.3	14.58	4.5	12775	2.0E-04
	50000	0.0005	0.0874	0.815	0.0001	296.5	25.3	14.58	4.5	12775	1.0E-04
	50000+	0.0002	0.0874	0.815	0.0000	297.5	25.3	14.58	4.5	12775	4.1E-05
	50000++	0.0001	0.0874	0.815	0.0000	298.5	25.3	14.58	4.5	12775	2.1E-05

	Distance (m)	Fog Oil Concentration (g/m²)	Skin Surface Area (m²)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Dermal Absorption									
	7500	0.01	0.275	1	25.3	14.58	4.5	12775	1.8E-05
	10000	0.005	0.275	1	25.3	14.58	4.5	12775	8.8E-06
	18000	0.002	0.275	1	25.3	14.58	4.5	12775	3.5E-06
	30000	0.001	0.275	1	25.3	14.58	4.5	12775	1.8E-06
	50000	0.0005	0.275	1	25.3	14.58	4.5	12775	8.8E-07
	50000+	0.0002	0.275	1	25.3	14.58	4.5	12775	3.5E-07
	50000++	0.0001	0.275	1	25.3	14.58	4.5	12775	1.8E-07

Bald eagle intake for fog oil under Pasquill Category E.

	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Inhalation										
Musgrave Hollow										
South Nest	25174	0.0002	1.31	0.055	0.136	25.3	20.42	4.5	12775	2.5E-07
Mid Nest	27956	0.0002	1.31	0.055	0.136	25.3	20.42	4.5	12775	2.5E-07
North Nest	48211	0.0001	1.31	0.055	0.136	25.3	20.42	4.5	12775	1.2E-07
Bally McCann Hollow										
South Nest	19717	0.0002	1.31	0.055	0.136	19.0	20.42	4.5	12775	1.8E-07
Mid Nest	23623	0.0002	1.31	0.055	0.136	19.0	20.42	4.5	12775	1.8E-07
North Nest	44956	0.0001	1.31	0.055	0.136	19.0	20.42	4.5	12775	9.2E-08
Mush Paddle Hollow										
South Nest	20749	0.0002	1.31	0.055	0.136	15.8	20.42	4.5	12775	1.5E-07
Mid Nest	28050	0.0002	1.31	0.055	0.136	15.8	20.42	4.5	12775	1.5E-07
North Nest	49712	0.0001	1.31	0.055	0.136	15.8	20.42	4.5	12775	7.7E-08
Ballard Hollow										
South Nest	17463	0.0002	1.31	0.055	0.136	12.7	20.42	4.5	12775	1.2E-07
Mid Nest	11677	0.0005	1.31	0.055	0.136	12.7	20.42	4.5	12775	3.1E-07
North Nest	34057	0.0001	1.31	0.055	0.136	12.7	20.42	4.5	12775	6.1E-08

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Dermal Absorption									
Musgrave Hollow									
South Nest	25174	0.001	0.275	1	25.3	20.42	4.5	12775	2.5E-06
Mid Nest	27956	0.001	0.275	1	25.3	20.42	4.5	12775	2.5E-06
North Nest	48211	0.0005	0.275	1	25.3	20.42	4.5	12775	1.2E-06
Bally McCann Hollow									
South Nest	19717	0.001	0.275	1	19.0	20.42	4.5	12775	1.9E-06
Mid Nest	23623	0.001	0.275	1	19.0	20.42	4.5	12775	1.9E-06
North Nest	44956	0.0004	0.275	1	19.0	20.42	4.5	12775	7.4E-07
Mush Paddle Hollow									
South Nest	20749	0.001	0.275	1	15.8	20.42	4.5	12775	1.5E-06
Mid Nest	28050	0.002	0.275	1	15.8	20.42	4.5	12775	3.1E-06
North Nest	49712	0.0005	0.275	1	15.8	20.42	4.5	12775	7.7E-07
Ballard Hollow									
South Nest	17463	0.002	0.275	1	12.7	20.42	4.5	12775	2.5E-06
Mid Nest	11677	0.002	0.275	1	12.7	20.42	4.5	12775	2.5E-06
North Nest	34057	0.0005	0.275	1	12.7	20.42	4.5	12775	6.2E-07

Attachment E: Terephthalic Acid (TPA) Grenades

Bald eagle intake for TPA under Pasquill Category B.

TPA Smoke Grenade										
	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Winter Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	2242	14.58	4.5	12775	3.0E-06
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	2242	14.58	4.5	12775	1.7E-09
	4000	0.002	3.4E-04	1.4E-05	5.9E-07	2242	14.58	4.5	12775	6.7E-10
	4000	0.001	3.4E-04	1.4E-05	5.9E-07	2242	14.58	4.5	12775	3.4E-10
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	2242	14.58	4.5	12775	1.7E-10
	5000	0.0002	3.4E-04	1.4E-05	5.9E-07	2242	14.58	4.5	12775	6.7E-11
	6000	0.0001	3.4E-04	1.4E-05	5.9E-07	2242	14.58	4.5	12775	3.4E-11

Attachment E: TPA Smoke Pots

Bald eagle intake for TPA under Pasquill Category B.

TPA Smoke Pot										
	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Winter Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	950	14.58	4.5	12775	1.3E-06
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	950	14.58	4.5	12775	7.1E-10
	5000	0.002	3.4E-04	1.4E-05	5.9E-07	950	14.58	4.5	12775	2.8E-10
	5000	0.001	3.4E-04	1.4E-05	5.9E-07	950	14.58	4.5	12775	1.4E-10
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	950	14.58	4.5	12775	7.1E-11
	6000	0.0002	3.4E-04	1.4E-05	5.9E-07	950	14.58	4.5	12775	2.8E-11
	7000	0.0001	3.4E-04	1.4E-05	5.9E-07	950	14.58	4.5	12775	1.4E-11

Attachment E: Titanium Dioxide Grenades

Bald eagle intake for titanium dioxide under Pasquill Category E.

	Distance (m)	Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Inhalation										
	100	0.01	3.4E-04	1.4E-05	5.9E-07	48	20.42	4.5	12775	1.0E-10
	300	0.005	3.4E-04	1.4E-05	5.9E-07	48	20.42	4.5	12775	5.0E-11
	500	0.002	3.4E-04	1.4E-05	5.9E-07	48	20.42	4.5	12775	2.0E-11
	700	0.001	3.4E-04	1.4E-05	5.9E-07	48	20.42	4.5	12775	1.0E-11
	1000	0.0005	3.4E-04	1.4E-05	5.9E-07	48	20.42	4.5	12775	5.0E-12
	1400	0.0002	3.4E-04	1.4E-05	5.9E-07	48	20.42	4.5	12775	2.0E-12
	1800	0.0001	3.4E-04	1.4E-05	5.9E-07	48	20.42	4.5	12775	1.0E-12

	Distance (m)	Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Winter Inhalation										
	100	0.01	3.4E-04	1.4E-05	5.9E-07	48	14.58	4.5	12775	7.2E-11
	300	0.005	3.4E-04	1.4E-05	5.9E-07	48	14.58	4.5	12775	3.6E-11
	500	0.002	3.4E-04	1.4E-05	5.9E-07	48	14.58	4.5	12775	1.4E-11
	700	0.001	3.4E-04	1.4E-05	5.9E-07	48	14.58	4.5	12775	7.2E-12
	1000	0.0005	3.4E-04	1.4E-05	5.9E-07	48	14.58	4.5	12775	3.6E-12
	1400	0.0002	3.4E-04	1.4E-05	5.9E-07	48	14.58	4.5	12775	1.4E-12
	1800	0.0001	3.4E-04	1.4E-05	5.9E-07	48	14.58	4.5	12775	7.2E-13

Attachment F
Risk Characterization - Indiana Bat

RISK PARAMETERS FOR INDIANA BATS

Summer Foraging/Roosting Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Daily Chronic Intake Value		Amount of stressor taken in by the receptor, averaged over its lifetime, per day.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Chronic Dose Adjusted Toxicity Reference Value	Chronic Dose Adjusted TRV	A toxicological value adjusted by multiplicative uncertainty factors for chronic (averaged over the receptor's lifespan) exposure.
Acute Hazard Quotient		Equal to expected exposure $concentration_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $intake_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

Summer Foraging/Roosting Ingestion

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Daily Chronic Intake Value		Amount of stressor taken in by the receptor, averaged over its lifetime, per day.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Acute Hazard Quotient		Equal to expected exposure $concentration_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $intake_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

RISK PARAMETERS FOR INDIANA BATS

Summer Foraging/Roosting Dermal Absorption

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Skin Surface Area		Surface area of receptor.
Dermally Absorbed Dose		Amount of chemical stressor dermally absorbed by receptor.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Acute Hazard Quotient		Equal to expected exposure $\text{concentration}_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $\text{intake}_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

Winter Hibernation Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Daily Chronic Intake Value		Amount of stressor taken in by the receptor, averaged over its lifetime, per day.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Chronic Dose Adjusted Toxicity Reference Value	Chronic Dose Adjusted TRV	A toxicological value adjusted by multiplicative uncertainty factors for chronic (averaged over the receptor's lifespan) exposure.
Acute Hazard Quotient		Equal to expected exposure $\text{concentration}_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $\text{intake}_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

RISK PARAMETERS FOR INDIANA BATS

Winter Hibernation Dermal Absorption

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Skin Surface Area		Surface area of receptor.
Dermally Absorbed Dose		Amount of chemical stressor dermally absorbed by receptor.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Acute Hazard Quotient		Equal to expected exposure $concentration_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $intake_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

Attachment F: Fog Oil - Static Smoke

Indiana bat risk characterization for fog oil exposure under Pasquill Category B.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hibernation Inhalation														
Musgrave Hollow														
Brooks	8031	1.0E-04	2.0E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	9.7E-03	No	No
Davis #2	6624	1.0E-03	6.4E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	3.0E-01	No	No
Wolf Den	8609	1.0E-04	4.2E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	2.0E-02	No	No
Joy	5447	5.0E-04	3.5E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	1.7E-01	No	No
Baily McCann Hollow														
Brooks	5803	2.0E-04	3.3E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	1.6E-02	No	No
Davis #2	2423	1.0E-02	6.7E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	3.2E+00	No	Yes
Wolf Den	3861	1.0E-02	4.5E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	2.2E+00	No	Yes
Joy	2004	1.0E-02	5.3E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	2.5E+00	No	Yes
Mush Paddle Hollow														
Brooks	10335	0.0E+00	0.0E+00	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	0.0E+00	0.0E+00	No	No
Davis #2	2889	1.0E-02	5.6E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	2.7E+00	No	Yes
Wolf Den	8432	1.0E-04	2.6E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	1.2E-02	No	No
Joy	1751	1.0E-02	3.4E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	1.6E+00	No	Yes
Ballard Hollow														
Brooks	8449	1.0E-04	1.0E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	4.9E-03	No	No
Davis #2	13352	0.0E+00	0.0E+00	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	0.0E+00	0.0E+00	No	No
Wolf Den	6859	2.0E-04	4.5E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	2.1E-02	No	No
Joy	13821	0.0E+00	0.0E+00	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	0.0E+00	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hibernation Dermal Absorption														
Musgrave Hollow														
Brooks	8031	5.0E-04	2.2E-02	6.4E-05	2	216	16	160	1.3E-01	1.4E+00	4.0E-03	4.7E-05	No	No
Davis #2	6624	1.0E-04	2.2E-02	1.3E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-04	9.5E-06	No	No
Wolf Den	8609	5.0E-04	2.2E-02	6.4E-05	2	216	16	160	1.3E-01	1.4E+00	4.0E-03	4.7E-05	No	No
Joy	5447	2.0E-04	2.2E-02	2.6E-05	2	216	16	160	1.3E-01	1.4E+00	1.6E-03	1.9E-05	No	No
Baily McCann Hollow														
Brooks	5803	2.0E-04	2.2E-02	1.9E-05	2	216	16	160	1.3E-01	1.4E+00	1.6E-03	1.4E-05	No	No
Davis #2	2423	1.0E-02	2.2E-02	9.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
Wolf Den	3861	1.0E-02	2.2E-02	9.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
Joy	2004	1.0E-02	2.2E-02	9.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
Mush Paddle Hollow														
Brooks	10335	2.0E-04	2.2E-02	1.6E-05	2	216	16	160	1.3E-01	1.4E+00	1.6E-03	1.2E-05	No	No
Davis #2	2889	1.0E-02	2.2E-02	8.0E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	5.9E-04	No	No
Wolf Den	8432	5.0E-04	2.2E-02	4.0E-05	2	216	16	160	1.3E-01	1.4E+00	4.0E-03	3.0E-05	No	No
Joy	1751	1.0E-02	2.2E-02	8.0E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	5.9E-04	No	No
Ballard Hollow														
Brooks	8449	5.0E-04	2.2E-02	3.2E-05	2	216	16	160	1.3E-01	1.4E+00	4.0E-03	2.4E-05	No	No
Davis #2	13352	2.0E-04	2.2E-02	1.3E-05	2	216	16	160	1.3E-01	1.4E+00	1.6E-03	9.5E-06	No	No
Wolf Den	6859	1.0E-03	2.2E-02	6.4E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	4.7E-05	No	No
Joy	13821	2.0E-04	2.2E-02	1.3E-05	2	216	16	160	1.3E-01	1.4E+00	1.6E-03	9.5E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

*Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Indiana bat risk characterization for fog oil exposure under Pasquill Category B.

Mobile Smoke

Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation													
4000	1.0E-02	1.5E-06	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	7.2E+00	No	Yes
4000	5.0E-03	7.6E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	3.6E+00	No	Yes
4000	2.0E-03	3.0E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	1.4E+00	No	Yes
5000	1.0E-03	1.5E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	7.2E-01	No	No
5000	5.0E-04	7.6E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	3.6E-01	No	No
7000	2.0E-04	3.0E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	1.4E-01	No	No
9000	1.0E-04	1.5E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	7.2E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Ingestion												
4000	9.7E-05	1.1E-03	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-05	7.7E-02	No	No
5000	4.9E-05	5.3E-04	17.6	22	16	1600	1.1E+00	1.4E-02	4.4E-05	3.8E-02	No	No
6000	1.9E-05	2.1E-04	17.6	22	16	1600	1.1E+00	1.4E-02	1.8E-05	1.5E-02	No	No
7500	9.7E-06	1.1E-04	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-06	7.7E-03	No	No
9500	4.9E-06	5.3E-05	17.6	22	16	1600	1.1E+00	1.4E-02	4.4E-06	3.8E-03	No	No
14500	1.9E-06	2.1E-05	17.6	22	16	1600	1.1E+00	1.4E-02	1.8E-06	1.5E-03	No	No
20000	9.7E-07	1.1E-05	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-07	7.7E-04	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney . Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Dermal Absorption													
4000	1.0E-02	2.2E-02	9.5E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
5000	5.0E-03	2.2E-02	4.8E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	3.5E-04	No	No
6000	2.0E-03	2.2E-02	1.9E-04	2	216	16	160	1.3E-01	1.4E+00	1.6E-02	1.4E-04	No	No
7500	1.0E-03	2.2E-02	9.5E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	7.1E-05	No	No
9500	5.0E-04	2.2E-02	4.8E-05	2	216	16	160	1.3E-01	1.4E+00	4.0E-03	3.5E-05	No	No
14500	2.0E-04	2.2E-02	1.9E-05	2	216	16	160	1.3E-01	1.4E+00	1.6E-03	1.4E-05	No	No
20000	1.0E-04	2.2E-02	9.5E-06	2	216	16	160	1.3E-01	1.4E+00	8.0E-04	7.1E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

*Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Indiana bat risk characterization for fog oil exposure under Pasquill Category C.

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hibernation Inhalation														
Musgrave Hollow														
Brooks	8031	2.0E-04	4.1E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	1.9E-02	No	No
Davis #2	6624	2.0E-04	1.3E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	6.1E-02	No	No
Wolf Den	8609	2.0E-04	8.3E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	4.0E-02	No	No
Joy	5447	5.0E-04	3.5E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	1.7E-01	No	No
Bally McCann Hollow														
Brooks	5803	5.0E-04	8.3E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	3.9E-02	No	No
Davis #2	2423	1.0E-02	6.7E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	3.2E+00	No	Yes
Wolf Den	3861	1.0E-03	4.5E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	2.2E-01	No	No
Joy	2004	1.0E-02	5.3E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	2.5E+00	No	Yes
Mush Paddle Hollow														
Brooks	10335	1.0E-04	0.0E+00	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	0.0E+00	No	No
Davis #2	2889	1.0E-02	5.6E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	2.7E+00	No	Yes
Wolf Den	8432	2.0E-04	5.2E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	2.5E-02	No	No
Joy	1751	1.0E-02	3.4E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	1.6E+00	No	Yes
Ballard Hollow														
Brooks	8449	2.0E-04	2.0E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	9.7E-03	No	No
Davis #2	13352	1.0E-04	0.0E+00	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	0.0E+00	No	No
Wolf Den	6859	2.0E-04	4.5E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	2.1E-02	No	No
Joy	13821	1.0E-04	0.0E+00	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m³)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hibernation Dermal Absorption														
Musgrave Hollow														
Brooks	8031	1.0E-03	2.2E-02	1.3E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	9.5E-05	No	No
Davis #2	6624	1.0E-03	2.2E-02	1.3E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	9.5E-05	No	No
Wolf Den	8609	5.0E-04	2.2E-02	6.4E-05	2	216	16	160	1.3E-01	1.4E+00	4.0E-03	4.7E-05	No	No
Joy	5447	1.0E-03	2.2E-02	1.3E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	9.5E-05	No	No
Bally McCann Hollow														
Brooks	5803	1.0E-03	2.2E-02	9.6E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	7.1E-05	No	No
Davis #2	2423	1.0E-02	2.2E-02	9.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
Wolf Den	3861	5.0E-03	2.2E-02	4.8E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	3.6E-04	No	No
Joy	2004	1.0E-02	2.2E-02	9.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
Mush Paddle Hollow														
Brooks	10335	5.0E-04	2.2E-02	4.0E-05	2	216	16	160	1.3E-01	1.4E+00	4.0E-03	3.0E-05	No	No
Davis #2	2889	1.0E-02	2.2E-02	8.0E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	5.9E-04	No	No
Wolf Den	8432	1.0E-03	2.2E-02	8.0E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	5.9E-05	No	No
Joy	1751	1.0E-02	2.2E-02	8.0E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	5.9E-04	No	No
Ballard Hollow														
Brooks	8449	1.0E-03	2.2E-02	6.4E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	4.7E-05	No	No
Davis #2	13352	2.0E-04	2.2E-02	1.3E-05	2	216	16	160	1.3E-01	1.4E+00	1.6E-03	9.5E-06	No	No
Wolf Den	6859	1.0E-03	2.2E-02	6.4E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	4.7E-05	No	No
Joy	13821	2.0E-04	2.2E-02	1.3E-05	2	216	16	160	1.3E-01	1.4E+00	1.6E-03	9.5E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Indiana bat risk characterization for fog oil exposure under Pasquill Category C.

Mobile Smoke

Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation													
3000	1.0E-02	1.5E-06	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	7.2E+00	No	Yes
3000	5.0E-03	7.6E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	3.6E+00	No	Yes
3000	2.0E-03	3.0E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	1.4E+00	No	Yes
4500	1.0E-03	1.5E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	7.2E-01	No	No
6500	5.0E-04	7.6E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	3.6E-01	No	No
9500	2.0E-04	3.0E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	1.4E-01	No	No
14000	1.0E-04	1.5E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	7.2E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Ingestion												
3000	9.7E-05	1.1E-03	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-05	7.7E-02	No	No
4000	4.9E-05	5.3E-04	17.6	22	16	1600	1.1E+00	1.4E-02	4.4E-05	3.8E-02	No	No
5000	1.9E-05	2.1E-04	17.6	22	16	1600	1.1E+00	1.4E-02	1.8E-05	1.5E-02	No	No
8500	9.7E-06	1.1E-04	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-06	7.7E-03	No	No
12000	4.9E-06	5.3E-05	17.6	22	16	1600	1.1E+00	1.4E-02	4.4E-06	3.8E-03	No	No
24000	1.9E-06	2.1E-05	17.6	22	16	1600	1.1E+00	1.4E-02	1.8E-06	1.5E-03	No	No
40000	9.7E-07	1.1E-05	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-07	7.7E-04	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Dermal Absorption													
3000	1.0E-02	2.2E-02	9.5E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
4000	5.0E-03	2.2E-02	4.8E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	3.5E-04	No	No
5000	2.0E-03	2.2E-02	1.9E-04	2	216	16	160	1.3E-01	1.4E+00	1.6E-02	1.4E-04	No	No
8500	1.0E-03	2.2E-02	9.5E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	7.1E-05	No	No
12000	5.0E-04	2.2E-02	4.8E-05	2	216	16	160	1.3E-01	1.4E+00	4.0E-03	3.5E-05	No	No
24000	2.0E-04	2.2E-02	1.9E-05	2	216	16	160	1.3E-01	1.4E+00	1.6E-03	1.4E-05	No	No
40000	1.0E-04	2.2E-02	9.5E-06	2	216	16	160	1.3E-01	1.4E+00	8.0E-04	7.1E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Indiana bat risk characterization for fog oil exposure under Pasquill Category D.

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hibernation Inhalation														
Musgrave Hollow														
Brooks	8031	5.0E-04	1.0E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	4.9E-02	No	No
Davis #2	6624	5.0E-04	3.2E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	1.5E-01	No	No
Wolf Den	8609	5.0E-04	2.1E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	9.9E-02	No	No
Joy	5447	1.0E-03	7.0E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	3.3E-01	No	No
Baily McCann Hollow														
Brooks	5803	1.0E-03	1.7E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	7.9E-02	No	No
Davis #2	2423	1.0E-02	6.7E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	3.2E+00	No	Yes
Wolf Den	3861	2.0E-03	9.1E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	4.3E-01	No	No
Joy	2004	1.0E-02	5.3E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	2.5E+00	No	Yes
Mush Paddle Hollow														
Brooks	10335	2.0E-04	0.0E+00	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	0.0E+00	No	No
Davis #2	2889	1.0E-02	5.6E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	2.7E+00	No	Yes
Wolf Den	8432	5.0E-04	1.3E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	6.2E-02	No	No
Joy	1751	1.0E-02	3.4E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	1.6E+00	No	Yes
Ballard Hollow														
Brooks	8449	5.0E-04	5.1E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	2.4E-02	No	No
Davis #2	13352	2.0E-04	0.0E+00	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	0.0E+00	No	No
Wolf Den	6859	5.0E-04	1.1E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	5.3E-02	No	No
Joy	13821	2.0E-04	0.0E+00	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m²)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hibernation Dermal Absorption														
Musgrave Hollow														
Brooks	8031	5.0E-03	2.2E-02	6.4E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	4.7E-04	No	No
Davis #2	6624	5.0E-03	2.2E-02	6.4E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	4.7E-04	No	No
Wolf Den	8609	2.0E-03	2.2E-02	2.6E-04	2	216	16	160	1.3E-01	1.4E+00	1.6E-02	1.9E-04	No	No
Joy	5447	1.0E-02	2.2E-02	1.3E-03	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	9.5E-04	No	No
Baily McCann Hollow														
Brooks	5803	1.0E-02	2.2E-02	9.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
Davis #2	2423	1.0E-02	2.2E-02	9.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
Wolf Den	3861	1.0E-02	2.2E-02	9.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
Joy	2004	1.0E-02	2.2E-02	9.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
Mush Paddle Hollow														
Brooks	10335	2.0E-03	2.2E-02	1.6E-04	2	216	16	160	1.3E-01	1.4E+00	1.6E-02	1.2E-04	No	No
Davis #2	2889	1.0E-02	2.2E-02	8.0E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	5.9E-04	No	No
Wolf Den	8432	5.0E-03	2.2E-02	4.0E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	3.0E-04	No	No
Joy	1751	1.0E-02	2.2E-02	8.0E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	5.9E-04	No	No
Ballard Hollow														
Brooks	8449	5.0E-03	2.2E-02	3.2E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	2.4E-04	No	No
Davis #2	13352	2.0E-03	2.2E-02	1.3E-04	2	216	16	160	1.3E-01	1.4E+00	1.6E-02	9.5E-05	No	No
Wolf Den	6859	5.0E-03	2.2E-02	3.2E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	2.4E-04	No	No
Joy	13821	2.0E-03	2.2E-02	1.3E-04	2	216	16	160	1.3E-01	1.4E+00	1.6E-02	9.5E-05	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Indiana bat risk characterization for fog oil exposure under Pasquill Category D.

Mobile Smoke

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation														
	2500	1.0E-02	1.5E-06	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	7.2E+00	No	Yes
	3000	5.0E-03	7.6E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	3.6E+00	No	Yes
	4500	2.0E-03	3.0E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	1.4E+00	No	Yes
	6000	1.0E-03	1.5E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	7.2E-01	No	No
	9500	5.0E-04	7.6E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	3.6E-01	No	No
	16500	2.0E-04	3.0E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	1.4E-01	No	No
	26500	1.0E-04	1.5E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	7.2E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Ingestion													
	6500	9.7E-05	1.1E-03	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-05	7.7E-02	No	No
	8500	4.9E-05	5.3E-04	17.6	22	16	1600	1.1E+00	1.4E-02	4.4E-05	3.8E-02	No	No
	14500	1.9E-05	2.1E-04	17.6	22	16	1600	1.1E+00	1.4E-02	1.8E-05	1.5E-02	No	No
	22000	9.7E-06	1.1E-04	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-06	7.7E-03	No	No
	35500	4.9E-06	5.3E-05	17.6	22	16	1600	1.1E+00	1.4E-02	4.4E-06	3.8E-03	No	No
	50000+	1.9E-06	2.1E-05	17.6	22	16	1600	1.1E+00	1.4E-02	1.8E-06	1.5E-03	No	No
	50000++	9.7E-07	1.1E-05	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-07	7.7E-04	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m²)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Dermal Absorption														
	6500	1.0E-02	2.2E-02	9.5E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
	8500	5.0E-03	2.2E-02	4.8E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	3.5E-04	No	No
	14500	2.0E-03	2.2E-02	1.9E-04	2	216	16	160	1.3E-01	1.4E+00	1.6E-02	1.4E-04	No	No
	22000	1.0E-03	2.2E-02	9.5E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	7.1E-05	No	No
	35500	5.0E-04	2.2E-02	4.8E-05	2	216	16	160	1.3E-01	1.4E+00	4.0E-03	3.5E-05	No	No
	50000+	2.0E-04	2.2E-02	1.9E-05	2	216	16	160	1.3E-01	1.4E+00	1.6E-03	1.4E-05	No	No
	50000++	1.0E-04	2.2E-02	9.5E-06	2	216	16	160	1.3E-01	1.4E+00	8.0E-04	7.1E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Indiana bat risk characterization for fog oil exposure under Pasquill Category E.

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hibernation Inhalation														
Musgrave Hollow														
Brooks	8031	1.0E-03	2.0E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	9.7E-02	No	No
Davis #2	6624	2.0E-03	1.3E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	6.1E-01	No	No
Wolf Den	8609	1.0E-03	4.2E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	2.0E-01	No	No
Joy	5447	2.0E-03	1.4E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	6.7E-01	No	No
Baily McCann Hollow														
Brooks	5803	2.0E-03	3.3E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	1.6E-01	No	No
Davis #2	2423	1.0E-02	6.7E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	3.2E+00	No	Yes
Wolf Den	3861	5.0E-03	2.3E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	1.1E+00	No	Yes
Joy	2004	1.0E-02	5.3E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	2.5E+00	No	Yes
Mush Paddle Hollow														
Brooks	10335	5.0E-04	0.0E+00	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	0.0E+00	No	No
Davis #2	2889	1.0E-02	5.6E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	2.7E+00	No	Yes
Wolf Den	8432	1.0E-04	2.6E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	1.2E-02	No	No
Joy	1751	1.0E-02	3.4E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	1.6E+00	No	Yes
Ballard Hollow														
Brooks	8449	1.0E-03	1.0E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	4.9E-02	No	No
Davis #2	13352	5.0E-04	0.0E+00	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	0.0E+00	No	No
Wolf Den	6859	2.0E-03	4.5E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	2.1E-01	No	No
Joy	13821	5.0E-04	0.0E+00	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m²)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hibernation Dermal Absorption														
Musgrave Hollow														
Brooks	8031	5.0E-03	0.0220	6.4E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	4.7E-04	No	No
Davis #2	6624	1.0E-02	0.0220	1.3E-03	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	9.5E-04	No	No
Wolf Den	8609	5.0E-03	0.0220	6.4E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	4.7E-04	No	No
Joy	5447	1.0E-02	0.0220	1.3E-03	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	9.5E-04	No	No
Baily McCann Hollow														
Brooks	5803	1.0E-02	0.0220	9.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
Davis #2	2423	1.0E-02	0.0220	9.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
Wolf Den	3861	1.0E-02	0.0220	9.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
Joy	2004	1.0E-02	0.0220	9.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
Mush Paddle Hollow														
Brooks	10335	2.0E-03	0.0220	1.6E-04	2	216	16	160	1.3E-01	1.4E+00	1.6E-02	1.2E-04	No	No
Davis #2	2889	1.0E-02	0.0220	8.0E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	5.9E-04	No	No
Wolf Den	8432	5.0E-03	0.0220	4.0E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	3.0E-04	No	No
Joy	1751	1.0E-02	0.0220	8.0E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	5.9E-04	No	No
Ballard Hollow														
Brooks	8449	5.0E-03	0.0220	3.2E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	2.4E-04	No	No
Davis #2	13352	2.0E-03	0.0220	1.3E-04	2	216	16	160	1.3E-01	1.4E+00	1.6E-02	9.5E-05	No	No
Wolf Den	6859	5.0E-03	0.0220	3.2E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	2.4E-04	No	No
Joy	13821	2.0E-03	0.0220	1.3E-04	2	216	16	160	1.3E-01	1.4E+00	1.6E-02	9.5E-05	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

*Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Indiana bat risk characterization for fog oil exposure under Pasquill Category E.

Mobile Smoke

Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation													
3000	1.0E-02	1.5E-06	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	7.2E+00	No	Yes
4000	5.0E-03	7.6E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	3.6E+00	No	Yes
7000	2.0E-03	3.0E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	1.4E+00	No	Yes
10000	1.0E-03	1.5E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	7.2E-01	No	No
16000	5.0E-04	7.6E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	3.6E-01	No	No
30000	2.0E-04	3.0E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	1.4E-01	No	No
50000	1.0E-04	1.5E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	7.2E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Ingestion												
7500	9.7E-05	1.1E-03	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-05	7.7E-02	No	No
10000	4.9E-05	5.3E-04	17.6	22	16	1600	1.1E+00	1.4E-02	4.4E-05	3.8E-02	No	No
18000	1.9E-05	2.1E-04	17.6	22	16	1600	1.1E+00	1.4E-02	1.8E-05	1.5E-02	No	No
30000	9.7E-06	1.1E-04	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-06	7.7E-03	No	No
50000	4.9E-06	5.3E-05	17.6	22	16	1600	1.1E+00	1.4E-02	4.4E-06	3.8E-03	No	No
50000+	1.9E-06	2.1E-05	17.6	22	16	1600	1.1E+00	1.4E-02	1.8E-06	1.5E-03	No	No
50000++	9.7E-07	1.1E-05	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-07	7.7E-04	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Dermal Absorption													
7500	1.0E-02	0.0220	9.5E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	7.1E-04	No	No
10000	5.0E-03	0.0220	4.8E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	3.5E-04	No	No
18000	2.0E-03	0.0220	1.9E-04	2	216	16	160	1.3E-01	1.4E+00	1.6E-02	1.4E-04	No	No
30000	1.0E-03	0.0220	9.5E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	7.1E-05	No	No
50000	5.0E-04	0.0220	4.8E-05	2	216	16	160	1.3E-01	1.4E+00	4.0E-03	3.5E-05	No	No
50000+	2.0E-04	0.0220	1.9E-05	2	216	16	160	1.3E-01	1.4E+00	1.6E-03	1.4E-05	No	No
50000++	1.0E-04	0.0220	9.5E-06	2	216	16	160	1.3E-01	1.4E+00	8.0E-04	7.1E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

*Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Attachment F: Fog Oil - Mobile Smoke

Indiana bat risk characterization for fog oil exposure under Pasquill Category B.

Static Smoke

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation														
	4000	1.0E-02	2.6E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	1.2E+00	No	Yes
	4000	5.0E-03	1.3E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	6.1E-01	No	No
	5000	2.0E-03	5.1E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	2.4E-01	No	No
	5000	1.0E-03	2.6E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	1.2E-01	No	No
	6000	5.0E-04	1.3E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	6.1E-02	No	No
	8000	2.0E-04	5.1E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	2.4E-02	No	No
	12000	1.0E-04	2.6E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	1.2E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Ingestion													
	4000	9.7E-05	2.9E-04	17.60	22	16	1600	1.1E+00	1.4E-02	8.8E-05	2.1E-02	No	No
	5000	4.9E-05	1.5E-04	17.60	22	16	1600	1.1E+00	1.4E-02	4.4E-05	1.1E-02	No	No
	6000	1.9E-05	5.9E-05	17.60	22	16	1600	1.1E+00	1.4E-02	1.8E-05	4.3E-03	No	No
	7000	9.7E-06	2.9E-05	17.60	22	16	1600	1.1E+00	1.4E-02	8.8E-06	2.1E-03	No	No
	9500	4.9E-06	1.5E-05	17.60	22	16	1600	1.1E+00	1.4E-02	4.4E-06	1.1E-03	No	No
	14000	1.9E-06	5.9E-06	17.60	22	16	1600	1.1E+00	1.4E-02	1.8E-06	4.3E-04	No	No
	20000	9.7E-07	2.9E-06	17.60	22	16	1600	1.1E+00	1.4E-02	8.8E-07	2.1E-04	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney . Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Dermal Absorption														
	4000	1.0E-02	2.2E-02	2.7E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	2.0E-04	No	No
	5000	5.0E-03	2.2E-02	1.3E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	9.9E-05	No	No
	6000	2.0E-03	2.2E-02	5.3E-05	2	216	16	160	1.3E-01	1.4E+00	1.6E-02	4.0E-05	No	No
	7000	1.0E-03	2.2E-02	2.7E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	2.0E-05	No	No
	9500	5.0E-04	2.2E-02	1.3E-05	2	216	16	160	1.3E-01	1.4E+00	4.0E-03	9.9E-06	No	No
	14000	2.0E-04	2.2E-02	5.3E-06	2	216	16	160	1.3E-01	1.4E+00	1.6E-03	4.0E-06	No	No
	20000	1.0E-04	2.2E-02	2.7E-06	2	216	16	160	1.3E-01	1.4E+00	8.0E-04	2.0E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

*Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Indiana bat risk characterization for fog oil exposure under Pasquill Category B.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hiberation Inhalation														
Brooks	6037	2.0E-04	1.2E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	5.9E-03	No	No
Davis #2	3927	1.0E-02	2.5E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	1.2E+00	No	Yes
Wolf Den	3878	1.0E-02	1.7E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	8.0E-01	No	No
Joy	3682	1.0E-02	2.0E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	9.3E-01	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hibernation Dermal Absorption														
Brooks	6037	1.0E-03	2.2E-02	3.6E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	2.7E-05	No	No
Davis #2	3927	1.0E-02	2.2E-02	3.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	2.7E-04	No	No
Wolf Den	3878	1.0E-02	2.2E-02	3.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	2.7E-04	No	No
Joy	3682	1.0E-02	2.2E-02	3.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	2.7E-04	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

*Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Indiana bat risk characterization for fog oil exposure under Pasquill Category C.

Static Smoke

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation														
	3500	1.0E-02	2.6E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	1.2E+00	No	Yes
	3500	5.0E-03	1.3E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	6.1E-01	No	No
	4000	2.0E-03	5.1E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	2.4E-01	No	No
	5500	1.0E-03	2.6E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	1.2E-01	No	No
	7500	5.0E-04	1.3E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	6.1E-02	No	No
	12000	2.0E-04	5.1E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	2.4E-02	No	No
	18500	1.0E-04	2.6E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	1.2E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Ingestion													
	3500	9.7E-05	2.9E-04	17.60	22	16	1600	1.1E+00	1.4E-02	8.8E-05	2.1E-02	No	No
	4000	4.9E-05	1.5E-04	17.60	22	16	1600	1.1E+00	1.4E-02	4.4E-05	1.1E-02	No	No
	5500	1.9E-05	5.9E-05	17.60	22	16	1600	1.1E+00	1.4E-02	1.8E-05	4.3E-03	No	No
	8000	9.7E-06	2.9E-05	17.60	22	16	1600	1.1E+00	1.4E-02	8.8E-06	2.1E-03	No	No
	12000	4.9E-06	1.5E-05	17.60	22	16	1600	1.1E+00	1.4E-02	4.4E-06	1.1E-03	No	No
	24000	1.9E-06	5.9E-06	17.60	22	16	1600	1.1E+00	1.4E-02	1.8E-06	4.3E-04	No	No
	40000	9.7E-07	2.9E-06	17.60	22	16	1600	1.1E+00	1.4E-02	8.8E-07	2.1E-04	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m²)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Dermal Absorption														
	3500	1.0E-02	2.2E-02	2.7E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	2.0E-04	No	No
	4000	5.0E-03	2.2E-02	1.3E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	9.9E-05	No	No
	5500	2.0E-03	2.2E-02	5.3E-05	2	216	16	160	1.3E-01	1.4E+00	1.6E-02	4.0E-05	No	No
	8000	1.0E-03	2.2E-02	2.7E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	2.0E-05	No	No
	12000	5.0E-04	2.2E-02	1.3E-05	2	216	16	160	1.3E-01	1.4E+00	4.0E-03	9.9E-06	No	No
	24000	2.0E-04	2.2E-02	5.3E-06	2	216	16	160	1.3E-01	1.4E+00	1.6E-03	4.0E-06	No	No
	40000	1.0E-04	2.2E-02	2.7E-06	2	216	16	160	1.3E-01	1.4E+00	8.0E-04	2.0E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Indiana bat risk characterization for fog oil exposure under Pasquill Category C.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hiberation Inhalation														
Brooks	6037	5.0E-04	3.1E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	1.5E-02	No	No
Davis #2	3927	2.0E-03	5.0E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	2.4E-01	No	No
Wolf Den	3878	2.0E-03	3.4E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	1.6E-01	No	No
Joy	3682	2.0E-03	3.9E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	1.9E-01	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hibernation Dermal Absorption														
Brooks	6037	1.0E-03	2.2E-02	3.6E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	2.7E-05	No	No
Davis #2	3927	5.0E-03	2.2E-02	1.8E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	1.3E-04	No	No
Wolf Den	3878	5.0E-03	2.2E-02	1.8E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	1.3E-04	No	No
Joy	3682	5.0E-03	2.2E-02	1.8E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	1.3E-04	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Indiana bat risk characterization for fog oil exposure under Pasquill Category D.

Static Smoke

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation														
	3500	1.0E-02	2.6E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	1.2E+00	No	Yes
	4500	5.0E-03	1.3E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	6.1E-01	No	No
	6500	2.0E-03	5.1E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	2.4E-01	No	No
	8500	1.0E-03	2.6E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	1.2E-01	No	No
	12500	5.0E-04	1.3E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	6.1E-02	No	No
	22500	2.0E-04	5.1E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	2.4E-02	No	No
	35500	1.0E-04	2.6E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	1.2E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Ingestion													
	6500	9.7E-05	2.9E-04	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-05	2.1E-02	No	No
	8500	4.9E-05	1.5E-04	17.6	22	16	1600	1.1E+00	1.4E-02	4.4E-05	1.1E-02	No	No
	14000	1.9E-05	5.9E-05	17.6	22	16	1600	1.1E+00	1.4E-02	1.8E-05	4.3E-03	No	No
	22000	9.7E-06	2.9E-05	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-06	2.1E-03	No	No
	35500	4.9E-06	1.5E-05	17.6	22	16	1600	1.1E+00	1.4E-02	4.4E-06	1.1E-03	No	No
	50000+	1.9E-06	5.9E-06	17.6	22	16	1600	1.1E+00	1.4E-02	1.8E-06	4.3E-04	No	No
	50000++	9.7E-07	2.9E-06	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-07	2.1E-04	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Dermal Absorption														
	6500	1.0E-02	2.2E-02	2.7E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	2.0E-04	No	No
	8500	5.0E-03	2.2E-02	1.3E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	9.9E-05	No	No
	14000	2.0E-03	2.2E-02	5.3E-05	2	216	16	160	1.3E-01	1.4E+00	1.6E-02	4.0E-05	No	No
	22000	1.0E-03	2.2E-02	2.7E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	2.0E-05	No	No
	35500	5.0E-04	2.2E-02	1.3E-05	2	216	16	160	1.3E-01	1.4E+00	4.0E-03	9.9E-06	No	No
	50000+	2.0E-04	2.2E-02	5.3E-06	2	216	16	160	1.3E-01	1.4E+00	1.6E-03	4.0E-06	No	No
	50000++	1.0E-04	2.2E-02	2.7E-06	2	216	16	160	1.3E-01	1.4E+00	8.0E-04	2.0E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Indiana bat risk characterization for fog oil exposure under Pasquill Category D.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hiberation Inhalation														
Brooks	6037	1.0E-03	6.2E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	2.9E-02	No	No
Davis #2	3927	5.0E-03	1.3E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	6.0E-01	No	No
Wolf Den	3878	5.0E-03	8.5E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	4.0E-01	No	No
Joy	3682	5.0E-03	9.8E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	4.7E-01	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hibernation Dermal Absorption														
Brooks	6037	1.0E-02	2.2E-02	3.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	2.7E-04	No	No
Davis #2	3927	1.0E-02	2.2E-02	3.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	2.7E-04	No	No
Wolf Den	3878	1.0E-02	2.2E-02	3.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	2.7E-04	No	No
Joy	3682	1.0E-02	2.2E-02	3.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	2.7E-04	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Indiana bat risk characterization for fog oil exposure under Pasquill Category E.

Static Smoke

Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation													
4000	1.0E-02	2.6E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	1.2E+00	No	Yes
5000	5.0E-03	1.3E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	6.1E-01	No	No
9000	2.0E-03	5.1E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	2.4E-01	No	No
14000	1.0E-03	2.6E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	1.2E-01	No	No
24000	5.0E-04	1.3E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	6.1E-02	No	No
50000	2.0E-04	5.1E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	2.4E-02	No	No
50000+	1.0E-04	2.6E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	1.2E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Ingestion												
7500	9.7E-05	2.9E-04	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-05	2.1E-02	No	No
10000	4.9E-05	1.5E-04	17.6	22	16	1600	1.1E+00	1.4E-02	4.4E-05	1.1E-02	No	No
18000	1.9E-05	5.9E-05	17.6	22	16	1600	1.1E+00	1.4E-02	1.8E-05	4.3E-03	No	No
30000	9.7E-06	2.9E-05	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-06	2.1E-03	No	No
50000	4.9E-06	1.5E-05	17.6	22	16	1600	1.1E+00	1.4E-02	4.4E-06	1.1E-03	No	No
50000+	1.9E-06	5.9E-06	17.6	22	16	1600	1.1E+00	1.4E-02	1.8E-06	4.3E-04	No	No
50000++	9.7E-07	2.9E-06	17.6	22	16	1600	1.1E+00	1.4E-02	8.8E-07	2.1E-04	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Dermal Absorption													
7500	1.0E-02	0.0220	2.7E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	2.0E-04	No	No
10000	5.0E-03	0.0220	1.3E-04	2	216	16	160	1.3E-01	1.4E+00	4.0E-02	9.9E-05	No	No
18000	2.0E-03	0.0220	5.3E-05	2	216	16	160	1.3E-01	1.4E+00	1.6E-02	4.0E-05	No	No
30000	1.0E-03	0.0220	2.7E-05	2	216	16	160	1.3E-01	1.4E+00	8.0E-03	2.0E-05	No	No
50000	5.0E-04	0.0220	1.3E-05	2	216	16	160	1.3E-01	1.4E+00	4.0E-03	9.9E-06	No	No
50000+	2.0E-04	0.0220	5.3E-06	2	216	16	160	1.3E-01	1.4E+00	1.6E-03	4.0E-06	No	No
50000++	1.0E-04	0.0220	2.7E-06	2	216	16	160	1.3E-01	1.4E+00	8.0E-04	2.0E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

*Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Indiana bat risk characterization for fog oil exposure under Pasquill Category E.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hiberation Inhalation														
Brooks	6037	2.0E-03	1.2E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	5.9E-02	No	No
Davis #2	3927	1.0E-02	2.5E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	1.2E+00	No	Yes
Wolf Den	3878	1.0E-02	1.7E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	8.0E-01	No	No
Joy	3682	1.0E-02	2.0E-07	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	9.3E-01	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hibernation Dermal Absorption														
Brooks	6037	1.0E-02	0.0220	3.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	2.7E-04	No	No
Davis #2	3927	1.0E-02	0.0220	3.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	2.7E-04	No	No
Wolf Den	3878	1.0E-02	0.0220	3.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	2.7E-04	No	No
Joy	3682	1.0E-02	0.0220	3.6E-04	2	216	16	160	1.3E-01	1.4E+00	8.0E-02	2.7E-04	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

*Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Attachment F: Terephthalic Acid (TPA) Grenades

Indiana bat risk characterization for TPA exposure under Pasquill Category B.

TPA Smoke Grenades

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation														
	3000	9.0E+00	2.9E-03	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	3.0E+01	Yes	Yes
	4000	5.0E-03	1.6E-06	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	1.6E-02	No	No
	4000	2.0E-03	6.3E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	6.6E-03	No	No
	4000	1.0E-03	3.2E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	3.3E-03	No	No
	5000	5.0E-04	1.6E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	1.6E-03	No	No
	5000	2.0E-04	6.3E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	6.6E-04	No	No
	6000	1.0E-04	3.2E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	3.3E-04	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hiberation Inhalation														
	3000	9.0E+00	3.8E-03	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	4.0E+01	Yes	Yes
	4000	5.0E-03	2.1E-06	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	2.2E-02	No	No
	4000	2.0E-03	8.5E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	8.8E-03	No	No
	4000	1.0E-03	4.3E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	4.4E-03	No	No
	5000	5.0E-04	2.1E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	2.2E-03	No	No
	5000	2.0E-04	8.5E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	8.8E-04	No	No
	6000	1.0E-04	4.3E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	4.4E-04	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

Attachment F: TPA Smoke Pots

Indiana bat risk characterization for TPA exposure under Pasquill Category B.

TPA Smoke Pots

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation														
	3000	9.0E+00	8.6E-04	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	8.9E+00	Yes	Yes
	4000	5.0E-03	4.8E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	5.0E-03	No	No
	5000	2.0E-03	1.9E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	2.0E-03	No	No
	5000	1.0E-03	9.6E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	9.9E-04	No	No
	5000	5.0E-04	4.8E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	5.0E-04	No	No
	6000	2.0E-04	1.9E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	2.0E-04	No	No
	7000	1.0E-04	9.6E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	9.9E-05	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hiberation Inhalation														
	3000	9.0E+00	1.2E-03	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	1.2E+01	Yes	Yes
	4000	5.0E-03	6.4E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	6.7E-03	No	No
	5000	2.0E-03	2.6E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	2.7E-03	No	No
	5000	1.0E-03	1.3E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	1.3E-03	No	No
	5000	5.0E-04	6.4E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	6.7E-04	No	No
	6000	2.0E-04	2.6E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	2.7E-04	No	No
	7000	1.0E-04	1.3E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	1.3E-04	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

Attachment F: Titanium Dioxide Grenades

Indiana bat risk characterization for titanium dioxide exposure under Pasquill Category E.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	100	1.0E-02	4.8E-08	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-02	9.2E-02	No	No
	300	5.0E-03	2.4E-08	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-02	4.6E-02	No	No
	500	2.0E-03	9.7E-09	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-03	1.8E-02	No	No
	700	1.0E-03	4.8E-09	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-03	9.2E-03	No	No
	1000	5.0E-04	2.4E-09	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-03	4.6E-03	No	No
	1400	2.0E-04	9.7E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-04	1.8E-03	No	No
	1800	1.0E-04	4.8E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-04	9.2E-04	No	No

*Acute toxicity value assumed equal to unadjusted chronic LOAEL. Acute critical effects are respiratory irritation. Critical Study: Lewis 1992

**Chronic critical effects are respiratory irritation. Critical Study: Lewis 1992

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Hiberation Inhalation														
	100	1.0E-02	6.5E-08	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-02	1.2E-01	No	No
	300	5.0E-03	3.3E-08	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-02	6.2E-02	No	No
	500	2.0E-03	1.3E-08	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-03	2.5E-02	No	No
	700	1.0E-03	6.5E-09	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-03	1.2E-02	No	No
	1000	5.0E-04	3.3E-09	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-03	6.2E-03	No	No
	1400	2.0E-04	1.3E-09	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-04	2.5E-03	No	No
	1800	1.0E-04	6.5E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-04	1.2E-03	No	No

*Acute toxicity value assumed equal to unadjusted chronic LOAEL. Acute critical effects are respiratory irritation. Critical Study: Lewis 1992

**Chronic critical effects are respiratory irritation. Critical Study: Lewis 1992

Attachment G
Risk Characterization - Gray Bat

RISK PARAMETERS FOR GRAY BATS

Summer Foraging Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Daily Chronic Intake Value		Amount of stressor taken in by the receptor, averaged over its lifetime, per day.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Chronic Dose Adjusted Toxicity Reference Value	Chronic Dose Adjusted TRV	A toxicological value adjusted by multiplicative uncertainty factors for chronic (averaged over the receptor's lifespan) exposure.
Acute Hazard Quotient		Equal to expected exposure $\text{concentration}_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $\text{intake}_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

Summer Foraging Ingestion

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Daily Chronic Intake Value		Amount of stressor taken in by the receptor, averaged over its lifetime, per day.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Acute Hazard Quotient		Equal to expected exposure $\text{concentration}_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $\text{intake}_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

RISK PARAMETERS FOR GRAY BATS

Summer Foraging Dermal Absorption

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Skin Surface Area		Surface area of receptor.
Dermally Absorbed Dose		Amount of chemical stressor dermally absorbed by receptor.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Acute Hazard Quotient		Equal to expected exposure concentration$_{acute}$ divided by TRV$_{acute}$.
Chronic Hazard Quotient		Equal to daily intake$_{chronic}$ divided by TRV$_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

Maternity Cave Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Daily Chronic Intake Value		Amount of stressor taken in by the receptor, averaged over its lifetime, per day.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Chronic Dose Adjusted Toxicity Reference Value	Chronic Dose Adjusted TRV	A toxicological value adjusted by multiplicative uncertainty factors for chronic (averaged over the receptor's lifespan) exposure.
Acute Hazard Quotient		Equal to expected exposure concentration$_{acute}$ divided by TRV$_{acute}$.
Chronic Hazard Quotient		Equal to daily intake$_{chronic}$ divided by TRV$_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

RISK PARAMETERS FOR GRAY BATS

Maternity Cave Dermal Absorption

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Skin Surface Area		Surface area of receptor.
Dermally Absorbed Dose		Amount of chemical stressor dermally absorbed by receptor.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Acute Hazard Quotient		Equal to expected exposure $\text{concentration}_{\text{acute}}$ divided by $\text{TRV}_{\text{acute}}$.
Chronic Hazard Quotient		Equal to daily $\text{intake}_{\text{chronic}}$ divided by $\text{TRV}_{\text{chronic}}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

Attachment H
Risk Characterization - Bald Eagle

RISK PARAMETERS FOR BALD EAGLES

Winter Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Daily Chronic Intake Value		Amount of stressor taken in by the receptor, averaged over its lifetime, per day.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Chronic Dose Adjusted Toxicity Reference Value	Chronic Dose Adjusted TRV	A toxicological value adjusted by multiplicative uncertainty factors for chronic (averaged over the receptor's lifespan) exposure.
Acute Hazard Quotient		Equal to expected exposure $concentration_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $intake_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

Winter Ingestion

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Daily Chronic Intake Value		Amount of stressor taken in by the receptor, averaged over its lifetime, per day.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Acute Hazard Quotient		Equal to expected exposure $concentration_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $intake_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

RISK PARAMETERS FOR BALD EAGLES

Winter Dermal Absorption

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Skin Surface Area		Surface area of receptor.
Dermally Absorbed Dose		Amount of chemical stressor dermally absorbed by receptor.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Acute Hazard Quotient		Equal to expected exposure concentration$_{acute}$ divided by TRV$_{acute}$.
Chronic Hazard Quotient		Equal to daily intake$_{chronic}$ divided by TRV$_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

Summer Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Daily Chronic Intake Value		Amount of stressor taken in by the receptor, averaged over its lifetime, per day.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Chronic Dose Adjusted Toxicity Reference Value	Chronic Dose Adjusted TRV	A toxicological value adjusted by multiplicative uncertainty factors for chronic (averaged over the receptor's lifespan) exposure.
Acute Hazard Quotient		Equal to expected exposure concentration$_{acute}$ divided by TRV$_{acute}$.
Chronic Hazard Quotient		Equal to daily intake$_{chronic}$ divided by TRV$_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

RISK PARAMETERS FOR BALD EAGLES

Summer Dermal Absorption

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Skin Surface Area		Surface area of receptor.
Dermally Absorbed Dose		Amount of chemical stressor dermally absorbed by receptor.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Acute Hazard Quotient		Equal to expected exposure $concentration_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $intake_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect	-	Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

Attachment G: Fog Oil - Static Smoke

Gray bat risk characterization for fog oil exposure under Pasquill Category B.

Static Smoke	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	4000	0.0100	2.3E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	1.1E+00	No	Yes
	4000	0.0050	1.1E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-03	5.4E-01	No	No
	5000	0.0020	4.5E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-04	2.1E-01	No	No
	5000	0.0010	2.3E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	1.1E-01	No	No
	6000	0.0005	1.1E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	5.4E-02	No	No
	8000	0.0002	4.5E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	2.1E-02	No	No
	12000	0.0001	2.3E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	1.1E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987
**Chronic critical effects are minor lesions of the heart, liver, and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Ingestion													
	4000	0.0100	2.6E-04	17.6	22	16	1600	1.10	1.4E-02	9.1E-03	1.9E-02	No	No
	5000	0.0050	1.3E-04	17.6	22	16	1600	1.10	1.4E-02	4.5E-03	9.5E-03	No	No
	6000	0.0020	5.2E-05	17.6	22	16	1600	1.10	1.4E-02	1.8E-03	3.8E-03	No	No
	7000	0.0010	2.6E-05	17.6	22	16	1600	1.10	1.4E-02	9.1E-04	1.9E-03	No	No
	9500	0.0005	1.3E-05	17.6	22	16	1600	1.10	1.4E-02	4.5E-04	9.5E-04	No	No
	14000	0.0002	5.2E-06	17.6	22	16	1600	1.10	1.4E-02	1.8E-04	3.8E-04	No	No
	8500	0.0001	2.6E-06	17.6	22	16	1600	1.10	1.4E-02	9.1E-05	1.9E-04	No	No

*Acute critical effects are weight loss and lesion of the liver, spleen, and kidney. Critical Study: Bramachari 1958
**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Dermal Absorption														
	4000	0.0100	0.026	2.8E-04	2	216	16	160	0.13	1.4E+00	8.0E-02	2.1E-04	No	No
	5000	0.0050	0.026	1.4E-04	2	216	16	160	0.13	1.4E+00	4.0E-02	1.0E-04	No	No
	6000	0.0020	0.026	5.6E-05	2	216	16	160	0.13	1.4E+00	1.6E-02	4.1E-05	No	No
	7000	0.0010	0.026	2.8E-05	2	216	16	160	0.13	1.4E+00	8.0E-03	2.1E-05	No	No
	9500	0.0005	0.026	1.4E-05	2	216	16	160	0.13	1.4E+00	4.0E-03	1.0E-05	No	No
	14000	0.0002	0.026	5.6E-06	2	216	16	160	0.13	1.4E+00	1.6E-03	4.1E-06	No	No
	8500	0.0001	0.026	2.8E-06	2	216	16	160	0.13	1.4E+00	8.0E-04	2.1E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990
**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Gray bat risk characterization for fog oil exposure under Pasquill Category B.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Inhalation														
Saltpeter #3	3682	0.01	1.1E-06	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	5.2E+00	No	Yes
Freeman	12547	0.00	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	0.0E+00	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver, and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Dermal Absorption														
Saltpeter #3	3682	0.0100	0.0260	2.8E-04	2	216	16	160	0.13	1.4E+00	8.0E-02	2.1E-04	No	No
Freeman	12547	0.0002	0.0260	5.6E-06	2	216	16	160	0.13	1.4E+00	1.6E-03	4.1E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Gray bat risk characterization for fog oil exposure under Pasquill Category C.

Static Smoke

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	3500	0.0100	2.3E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	1.1E+00	No	Yes
	3500	0.0050	1.1E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-03	5.4E-01	No	No
	4000	0.0020	4.5E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-04	2.1E-01	No	No
	5500	0.0010	2.3E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	1.1E-01	No	No
	7500	0.0005	1.1E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	5.4E-02	No	No
	12000	0.0002	4.5E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	2.1E-02	No	No
	18500	0.0001	2.3E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	1.1E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987
**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Ingestion													
	3500	0.0100	2.6E-04	17.6	22	16	1600	1.10	1.4E-02	9.1E-03	1.9E-02	No	No
	4000	0.0050	1.3E-04	17.6	22	16	1600	1.10	1.4E-02	4.5E-03	9.5E-03	No	No
	5500	0.0020	5.2E-05	17.6	22	16	1600	1.10	1.4E-02	1.8E-03	3.8E-03	No	No
	8000	0.0010	2.6E-05	17.6	22	16	1600	1.10	1.4E-02	9.1E-04	1.9E-03	No	No
	12000	0.0005	1.3E-05	17.6	22	16	1600	1.10	1.4E-02	4.5E-04	9.5E-04	No	No
	24000	0.0002	5.2E-06	17.6	22	16	1600	1.10	1.4E-02	1.8E-04	3.8E-04	No	No
	40000	0.0001	2.6E-06	17.6	22	16	1600	1.10	1.4E-02	9.1E-05	1.9E-04	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958
**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Dermal Absorption														
	3500	0.0100	0.026	2.8E-04	2	216	16	160	0.13	1.4E+00	8.0E-02	2.1E-04	No	No
	4000	0.0050	0.026	1.4E-04	2	216	16	160	0.13	1.4E+00	4.0E-02	1.0E-04	No	No
	5500	0.0020	0.026	5.6E-05	2	216	16	160	0.13	1.4E+00	1.6E-02	4.1E-05	No	No
	8000	0.0010	0.026	2.8E-05	2	216	16	160	0.13	1.4E+00	8.0E-03	2.1E-05	No	No
	12000	0.0005	0.026	1.4E-05	2	216	16	160	0.13	1.4E+00	4.0E-03	1.0E-05	No	No
	24000	0.0002	0.026	5.6E-06	2	216	16	160	0.13	1.4E+00	1.6E-03	4.1E-06	No	No
	40000	0.0001	0.026	2.8E-06	2	216	16	160	0.13	1.4E+00	8.0E-04	2.1E-06	No	No

*Acute critical effect slight to moderate skin irritation. Critical Study: Palmer 1990
**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Gray bat risk characterization for fog oil exposure under Pasquill Category C.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Inhalation														
Saltpeter #3	3682	0.00	2.2E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-04	1.0E+00	No	Yes
Freeman	12547	0.00	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Dermal Absorption														
Saltpeter #3	3682	0.0050	0.0260	1.4E-04	2	216	16	160	0.13	1.4E+00	4.0E-02	1.0E-04	No	No
Freeman	12547	0.0002	0.0260	5.6E-06	2	216	16	160	0.13	1.4E+00	1.6E-03	4.1E-06	No	No

*Acute critical effect slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Gray bat risk characterization for fog oil exposure under Pasquill Category D.

Static Smoke

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	3500	0.0100	2.3E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	1.1E+00	No	Yes
	4500	0.0050	1.1E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-03	5.4E-01	No	No
	6500	0.0020	4.5E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-04	2.1E-01	No	No
	8500	0.0010	2.3E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	1.1E-01	No	No
	12500	0.0005	1.1E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	5.4E-02	No	No
	22500	0.0002	4.5E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	2.1E-02	No	No
	35500	0.0001	2.3E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	1.1E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Ingestion													
	6500	0.0100	2.6E-04	17.6	22	16	1600	1.10	1.4E-02	9.1E-03	1.9E-02	No	No
	8500	0.0050	1.3E-04	17.6	22	16	1600	1.10	1.4E-02	4.5E-03	9.5E-03	No	No
	14000	0.0020	5.2E-05	17.6	22	16	1600	1.10	1.4E-02	1.8E-03	3.8E-03	No	No
	22000	0.0010	2.6E-05	17.6	22	16	1600	1.10	1.4E-02	9.1E-04	1.9E-03	No	No
	35500	0.0005	1.3E-05	17.6	22	16	1600	1.10	1.4E-02	4.5E-04	9.5E-04	No	No
	50000+	0.0002	5.2E-06	17.6	22	16	1600	1.10	1.4E-02	1.8E-04	3.8E-04	No	No
	50000++	0.0001	2.6E-06	17.6	22	16	1600	1.10	1.4E-02	9.1E-05	1.9E-04	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Dermal Absorption														
	6500	0.0100	0.026	2.8E-04	2	216	16	160	0.13	1.4E+00	8.0E-02	2.1E-04	No	No
	8500	0.0050	0.026	1.4E-04	2	216	16	160	0.13	1.4E+00	4.0E-02	1.0E-04	No	No
	14000	0.0020	0.026	5.6E-05	2	216	16	160	0.13	1.4E+00	1.6E-02	4.1E-05	No	No
	22000	0.0010	0.026	2.8E-05	2	216	16	160	0.13	1.4E+00	8.0E-03	2.1E-05	No	No
	35500	0.0005	0.026	1.4E-05	2	216	16	160	0.13	1.4E+00	4.0E-03	1.0E-05	No	No
	50000+	0.0002	0.026	5.6E-06	2	216	16	160	0.13	1.4E+00	1.6E-03	4.1E-06	No	No
	50000++	0.0001	0.026	2.8E-06	2	216	16	160	0.13	1.4E+00	8.0E-04	2.1E-06	No	No

*Acute critical effect slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Gray bat risk characterization for fog oil exposure under Pasquill Category D.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Inhalation														
Saltpeter #3	3682	0.01	5.4E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-03	2.6E+00	No	Yes
Freeman	12547	0.00	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Dermal Absorption														
Saltpeter #3	3682	0.0100	0.0260	2.8E-04	2	216	16	160	0.13	1.4E+00	8.0E-02	2.1E-04	No	No
Freeman	12547	0.0020	0.0260	5.6E-05	2	216	16	160	0.13	1.4E+00	1.6E-02	4.1E-05	No	No

*Acute critical effect slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Gray bat risk characterization for fog oil exposure under Pasquill Category E.

Static Smoke	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	4000	0.0100	2.3E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	1.1E+00	No	Yes
	5000	0.0050	1.1E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-03	5.4E-01	No	No
	9000	0.0020	4.5E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-04	2.1E-01	No	No
	14000	0.0010	2.3E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	1.1E-01	No	No
	24000	0.0005	1.1E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	5.4E-02	No	No
	50000	0.0002	4.5E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	2.1E-02	No	No
	50000+	0.0001	2.3E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	1.1E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Ingestion													
	7500	0.0100	2.6E-04	17.6	22	16	1600	1.10	1.4E-02	9.1E-03	1.9E-02	No	No
	10000	0.0050	1.3E-04	17.6	22	16	1600	1.10	1.4E-02	4.5E-03	9.5E-03	No	No
	18000	0.0020	5.2E-05	17.6	22	16	1600	1.10	1.4E-02	1.8E-03	3.8E-03	No	No
	30000	0.0010	2.6E-05	17.6	22	16	1600	1.10	1.4E-02	9.1E-04	1.9E-03	No	No
	50000	0.0005	1.3E-05	17.6	22	16	1600	1.10	1.4E-02	4.5E-04	9.5E-04	No	No
	50000+	0.0002	5.2E-06	17.6	22	16	1600	1.10	1.4E-02	1.8E-04	3.8E-04	No	No
	50000++	0.0001	2.6E-06	17.6	22	16	1600	1.10	1.4E-02	9.1E-05	1.9E-04	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m²)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Dermal Absorption														
	7500	0.0100	0.026	2.8E-04	2	216	16	160	0.13	1.4E+00	8.0E-02	2.1E-04	No	No
	10000	0.0050	0.026	1.4E-04	2	216	16	160	0.13	1.4E+00	4.0E-02	1.0E-04	No	No
	18000	0.0020	0.026	5.6E-05	2	216	16	160	0.13	1.4E+00	1.6E-02	4.1E-05	No	No
	30000	0.0010	0.026	2.8E-05	2	216	16	160	0.13	1.4E+00	8.0E-03	2.1E-05	No	No
	50000	0.0005	0.026	1.4E-05	2	216	16	160	0.13	1.4E+00	4.0E-03	1.0E-05	No	No
	50000+	0.0002	0.026	5.6E-06	2	216	16	160	0.13	1.4E+00	1.6E-03	4.1E-06	No	No
	50000++	0.0001	0.026	2.8E-06	2	216	16	160	0.13	1.4E+00	8.0E-04	2.1E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Gray bat risk characterization for fog oil exposure under Pasquill Category E.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Inhalation														
Saltpeter #3	3682	0.01	1.1E-06	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	5.2E+00	No	Yes
Freeman	12547	0.00	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Dermal Absorption														
Saltpeter #3	3682	0.0100	0.0260	2.8E-04	2	216	16	160	0.13	1.4E+00	8.0E-02	2.1E-04	No	No
Freeman	12547	0.0020	0.0260	5.6E-05	2	216	16	160	0.13	1.4E+00	1.6E-02	4.1E-05	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Attachment G: Fog Oil - Mobile Smoke

Gray bat risk characterization for fog oil exposure under Pasquill Category B.

Mobile Smoke

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	4000	0.0100	1.3E-06	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	6.4E+00	No	Yes
	4000	0.0050	6.7E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-03	3.2E+00	No	Yes
	4000	0.0020	2.7E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-04	1.3E+00	No	Yes
	5000	0.0010	1.3E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	6.4E-01	No	No
	5000	0.0005	6.7E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	3.2E-01	No	No
	7000	0.0002	2.7E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	1.3E-01	No	No
	9000	0.0001	1.3E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	6.4E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987
**Chronic critical effects are minor lesions of the heart, liver, and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Ingestion													
	4000	0.0100	9.3E-07	17.6	22	16	1600	1.10	1.4E-02	9.1E-03	6.8E-05	No	No
	5000	0.0050	4.7E-07	17.6	22	16	1600	1.10	1.4E-02	4.5E-03	3.4E-05	No	No
	6000	0.0020	1.9E-07	17.6	22	16	1600	1.10	1.4E-02	1.8E-03	1.4E-05	No	No
	7500	0.0010	9.3E-08	17.6	22	16	1600	1.10	1.4E-02	9.1E-04	6.8E-06	No	No
	9500	0.0005	4.7E-08	17.6	22	16	1600	1.10	1.4E-02	4.5E-04	3.4E-06	No	No
	14500	0.0002	1.9E-08	17.6	22	16	1600	1.10	1.4E-02	1.8E-04	1.4E-06	No	No
	8500	0.0001	9.3E-09	17.6	22	16	1600	1.10	1.4E-02	9.1E-05	6.8E-07	No	No

*Acute critical effects are weight loss and lesion of the liver, spleen, and kidney. Critical Study: Bramachari 1958
**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Dermal Absorption														
	4000	0.0100	0.0260	1.0E-03	2	216	16	160	0.13	1.4E+00	8.0E-02	7.4E-04	No	No
	5000	0.0050	0.0260	5.0E-04	2	216	16	160	0.13	1.4E+00	4.0E-02	3.7E-04	No	No
	6000	0.0020	0.0260	2.0E-04	2	216	16	160	0.13	1.4E+00	1.6E-02	1.5E-04	No	No
	7500	0.0010	0.0260	1.0E-04	2	216	16	160	0.13	1.4E+00	8.0E-03	7.4E-05	No	No
	9500	0.0005	0.0260	5.0E-05	2	216	16	160	0.13	1.4E+00	4.0E-03	3.7E-05	No	No
	14500	0.0002	0.0260	2.0E-05	2	216	16	160	0.13	1.4E+00	1.6E-03	1.5E-05	No	No
	8500	0.0001	0.0260	1.0E-05	2	216	16	160	0.13	1.4E+00	8.0E-04	7.4E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990
**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Gray bat risk characterization for fog oil exposure under Pasquill Category B.

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Inhalation														
Musgrave Hollow														
Saltpeter #3	5447	0.0010	3.2E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	1.5E+00	No	Yes
Freeman	13104	0.0000	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	0.0E+00	0.0E+00	No	No
Bally McCann Hollow														
Saltpeter #3	2004	0.0100	3.0E-06	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	1.4E+01	No	Yes
Freeman	12024	0.0000	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	0.0E+00	0.0E+00	No	No
Mush Paddle Hollow														
Saltpeter #3	1751	0.0100	2.5E-06	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	1.2E+01	No	Yes
Freeman	16542	0.0000	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	0.0E+00	0.0E+00	No	No
Ballard Hollow														
Saltpeter #3	13821	0.0000	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	0.0E+00	0.0E+00	No	No
Freeman	11266	0.0000	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	0.0E+00	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver, and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m²)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Dermal Absorption														
Musgrave Hollow														
Saltpeter #3	5447	0.0020	0.0260	2.0E-04	2	216	16	160	0.13	1.4E+00	1.6E-02	1.5E-04	No	No
Freeman	13104	0.0002	0.0260	2.0E-05	2	216	16	160	0.13	1.4E+00	1.6E-03	1.5E-05	No	No
Bally McCann Hollow														
Saltpeter #3	2004	0.0100	0.0260	7.5E-04	2	216	16	160	0.13	1.4E+00	8.0E-02	5.5E-04	No	No
Freeman	12024	0.0002	0.0260	1.5E-05	2	216	16	160	0.13	1.4E+00	1.6E-03	1.1E-05	No	No
Mush Paddle Hollow														
Saltpeter #3	1751	0.0100	0.0260	6.2E-04	2	216	16	160	0.13	1.4E+00	8.0E-02	4.6E-04	No	No
Freeman	16542	0.0001	0.0260	6.2E-06	2	216	16	160	0.13	1.4E+00	8.0E-04	4.6E-06	No	No
Ballard Hollow														
Saltpeter #3	13821	0.0002	0.0260	1.0E-05	2	216	16	160	0.13	1.4E+00	1.6E-03	7.4E-06	No	No
Freeman	11266	0.0002	0.0260	1.0E-05	2	216	16	160	0.13	1.4E+00	1.6E-03	7.4E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Gray bat risk characterization for fog oil exposure under Pasquill Category C.

Mobile Smoke

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	3000	0.0100	1.3E-06	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	6.4E+00	No	Yes
	3000	0.0050	6.7E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-03	3.2E+00	No	Yes
	3000	0.0020	2.7E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-04	1.3E+00	No	Yes
	4500	0.0010	1.3E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	6.4E-01	No	No
	6500	0.0005	6.7E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	3.2E-01	No	No
	9500	0.0002	2.7E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	1.3E-01	No	No
	14000	0.0001	1.3E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	6.4E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Ingestion													
	3000	0.0100	9.3E-07	17.6	22	16	1600	1.10	1.4E-02	9.1E-03	6.8E-05	No	No
	4000	0.0050	4.7E-07	17.6	22	16	1600	1.10	1.4E-02	4.5E-03	3.4E-05	No	No
	5000	0.0020	1.9E-07	17.6	22	16	1600	1.10	1.4E-02	1.8E-03	1.4E-05	No	No
	8500	0.0010	9.3E-08	17.6	22	16	1600	1.10	1.4E-02	9.1E-04	6.8E-06	No	No
	12000	0.0005	4.7E-08	17.6	22	16	1600	1.10	1.4E-02	4.5E-04	3.4E-06	No	No
	24000	0.0002	1.9E-08	17.6	22	16	1600	1.10	1.4E-02	1.8E-04	1.4E-06	No	No
	40000	0.0001	9.3E-09	17.6	22	16	1600	1.10	1.4E-02	9.1E-05	6.8E-07	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m²)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Dermal Absorption														
	3000	0.0100	0.0260	1.0E-03	2	216	16	160	0.13	1.4E+00	8.0E-02	7.4E-04	No	No
	4000	0.0050	0.0260	5.0E-04	2	216	16	160	0.13	1.4E+00	4.0E-02	3.7E-04	No	No
	5000	0.0020	0.0260	2.0E-04	2	216	16	160	0.13	1.4E+00	1.6E-02	1.5E-04	No	No
	8500	0.0010	0.0260	1.0E-04	2	216	16	160	0.13	1.4E+00	8.0E-03	7.4E-05	No	No
	12000	0.0005	0.0260	5.0E-05	2	216	16	160	0.13	1.4E+00	4.0E-03	3.7E-05	No	No
	24000	0.0002	0.0260	2.0E-05	2	216	16	160	0.13	1.4E+00	1.6E-03	1.5E-05	No	No
	40000	0.0001	0.0260	1.0E-05	2	216	16	160	0.13	1.4E+00	8.0E-04	7.4E-06	No	No

*Acute critical effect slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Gray bat risk characterization for fog oil exposure under Pasquill Category C.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Inhalation														
Musgrave Hollow														
Saltpeter #3	5447	0.0005	1.6E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	7.5E-01	No	No
Freeman	13104	0.0001	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	0.0E+00	No	No
Bally McCann Hollow														
Saltpeter #3	2004	0.0100	3.0E-06	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	1.4E+01	No	Yes
Freeman	12024	0.0001	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	0.0E+00	No	No
Mush Paddle Hollow														
Saltpeter #3	1751	0.0100	2.5E-06	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	1.2E+01	No	Yes
Freeman	16542	0.0001	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	0.0E+00	No	No
Ballard Hollow														
Saltpeter #3	13821	0.0001	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	0.0E+00	No	No
Freeman	11266	0.0001	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Dermal Absorption														
Musgrave Hollow														
Saltpeter #3	5447	0.0010	0.0260	1.0E-04	2	216	16	160	0.13	1.4E+00	8.0E-03	7.4E-05	No	No
Freeman	13104	0.0002	0.0260	2.0E-05	2	216	16	160	0.13	1.4E+00	1.6E-03	1.5E-05	No	No
Bally McCann Hollow														
Saltpeter #3	2004	0.0100	0.0260	7.5E-04	2	216	16	160	0.13	1.4E+00	8.0E-02	5.5E-04	No	No
Freeman	12024	0.0005	0.0260	3.7E-05	2	216	16	160	0.13	1.4E+00	4.0E-03	2.8E-05	No	No
Mush Paddle Hollow														
Saltpeter #3	1751	0.0100	0.0260	6.2E-04	2	216	16	160	0.13	1.4E+00	8.0E-02	4.6E-04	No	No
Freeman	16542	0.0002	0.0260	1.2E-05	2	216	16	160	0.13	1.4E+00	1.6E-03	9.2E-06	No	No
Ballard Hollow														
Saltpeter #3	13821	0.0002	0.0260	1.0E-05	2	216	16	160	0.13	1.4E+00	1.6E-03	7.4E-06	No	No
Freeman	11266	0.0005	0.0260	2.5E-05	2	216	16	160	0.13	1.4E+00	4.0E-03	1.8E-05	No	No

*Acute critical effect slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Gray bat risk characterization for fog oil exposure under Pasquill Category D.

Mobile Smoke

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	2500	0.0100	1.3E-06	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	6.4E+00	No	Yes
	3000	0.0050	6.7E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-03	3.2E+00	No	Yes
	4500	0.0020	2.7E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-04	1.3E+00	No	Yes
	6000	0.0010	1.3E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	6.4E-01	No	No
	9500	0.0005	6.7E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	3.2E-01	No	No
	16500	0.0002	2.7E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	1.3E-01	No	No
	26500	0.0001	1.3E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	6.4E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987
**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Ingestion													
	6500	0.0100	9.3E-07	17.6	22	16	1600	1.10	1.4E-02	9.1E-03	6.8E-05	No	No
	8500	0.0050	4.7E-07	17.6	22	16	1600	1.10	1.4E-02	4.5E-03	3.4E-05	No	No
	14500	0.0020	1.9E-07	17.6	22	16	1600	1.10	1.4E-02	1.8E-03	1.4E-05	No	No
	22000	0.0010	9.3E-08	17.6	22	16	1600	1.10	1.4E-02	9.1E-04	6.8E-06	No	No
	35500	0.0005	4.7E-08	17.6	22	16	1600	1.10	1.4E-02	4.5E-04	3.4E-06	No	No
	50000+	0.0002	1.9E-08	17.6	22	16	1600	1.10	1.4E-02	1.8E-04	1.4E-06	No	No
	50000++	0.0001	9.3E-09	17.6	22	16	1600	1.10	1.4E-02	9.1E-05	6.8E-07	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958
**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m²)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Dermal Absorption														
	6500	0.0100	0.0260	1.0E-03	2	216	16	160	0.13	1.4E+00	8.0E-02	7.4E-04	No	No
	8500	0.0050	0.0260	5.0E-04	2	216	16	160	0.13	1.4E+00	4.0E-02	3.7E-04	No	No
	14500	0.0020	0.0260	2.0E-04	2	216	16	160	0.13	1.4E+00	1.6E-02	1.5E-04	No	No
	22000	0.0010	0.0260	1.0E-04	2	216	16	160	0.13	1.4E+00	8.0E-03	7.4E-05	No	No
	35500	0.0005	0.0260	5.0E-05	2	216	16	160	0.13	1.4E+00	4.0E-03	3.7E-05	No	No
	50000+	0.0002	0.0260	2.0E-05	2	216	16	160	0.13	1.4E+00	1.6E-03	1.5E-05	No	No
	.50000++	0.0001	0.0260	1.0E-05	2	216	16	160	0.13	1.4E+00	8.0E-04	7.4E-06	No	No

*Acute critical effect slight to moderate skin irritation. Critical Study: Palmer 1990
**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Gray bat risk characterization for fog oil exposure under Pasquill Category D.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Inhalation														
Musgrave Hollow														
Saltpeter #3	5447	0.0010	1.1E-10	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	5.1E-04	No	No
Freeman	13104	0.0002	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	0.0E+00	No	No
Baily McCann Hollow														
Saltpeter #3	2004	0.0100	1.0E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	4.8E-03	No	No
Freeman	12024	0.0002	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	0.0E+00	No	No
Mush Paddle Hollow														
Saltpeter #3	1751	0.0100	8.4E-10	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	4.0E-03	No	No
Freeman	16542	0.0002	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	0.0E+00	No	No
Ballard Hollow														
Saltpeter #3	13821	0.0002	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	0.0E+00	No	No
Freeman	11266	0.0002	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Dermal Absorption														
Musgrave Hollow														
Saltpeter #3	5447	0.0100	0.0260	1.0E-03	2	216	16	160	0.13	1.4E+00	8.0E-02	7.4E-04	No	No
Freeman	13104	0.0020	0.0260	2.0E-04	2	216	16	160	0.13	1.4E+00	1.6E-02	1.5E-04	No	No
Baily McCann Hollow														
Saltpeter #3	2004	0.0100	0.0260	7.5E-04	2	216	16	160	0.13	1.4E+00	8.0E-02	5.5E-04	No	No
Freeman	12024	0.0020	0.0260	1.5E-04	2	216	16	160	0.13	1.4E+00	1.6E-02	1.1E-04	No	No
Mush Paddle Hollow														
Saltpeter #3	1751	0.0100	0.0260	6.2E-04	2	216	16	160	0.13	1.4E+00	8.0E-02	4.6E-04	No	No
Freeman	16542	0.0010	0.0260	6.2E-05	2	216	16	160	0.13	1.4E+00	8.0E-03	4.6E-05	No	No
Ballard Hollow														
Saltpeter #3	13821	0.0020	0.0260	1.0E-04	2	216	16	160	0.13	1.4E+00	1.6E-02	7.4E-05	No	No
Freeman	11266	0.0020	0.0260	1.0E-04	2	216	16	160	0.13	1.4E+00	1.6E-02	7.4E-05	No	No

*Acute critical effect slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Gray bat risk characterization for fog oil exposure under Pasquill Category E.

Mobile Smoke

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	3000	0.0100	1.3E-06	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	6.4E+00	No	Yes
	4000	0.0050	6.7E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-03	3.2E+00	No	Yes
	7000	0.0020	2.7E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-04	1.3E+00	No	Yes
	10000	0.0010	1.3E-07	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	6.4E-01	No	No
	16000	0.0005	6.7E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	3.2E-01	No	No
	30000	0.0002	2.7E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	1.3E-01	No	No
	50000	0.0001	1.3E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	6.4E-02	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987
**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Ingestion													
	7500	0.0100	9.3E-07	17.6	22	16	1600	1.10	1.4E-02	9.1E-03	6.8E-05	No	No
	10000	0.0050	4.7E-07	17.6	22	16	1600	1.10	1.4E-02	4.5E-03	3.4E-05	No	No
	18000	0.0020	1.9E-07	17.6	22	16	1600	1.10	1.4E-02	1.8E-03	1.4E-05	No	No
	30000	0.0010	9.3E-08	17.6	22	16	1600	1.10	1.4E-02	9.1E-04	6.8E-06	No	No
	50000	0.0005	4.7E-08	17.6	22	16	1600	1.10	1.4E-02	4.5E-04	3.4E-06	No	No
	50000+	0.0002	1.9E-08	17.6	22	16	1600	1.10	1.4E-02	1.8E-04	1.4E-06	No	No
	50000++	0.0001	9.3E-09	17.6	22	16	1600	1.10	1.4E-02	9.1E-05	6.8E-07	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958
**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Dermal Absorption														
	7500	0.0100	0.0260	1.0E-03	2	216	16	160	0.1250	1.4E+00	8.0E-02	7.4E-04	No	No
	10000	0.0050	0.0260	5.0E-04	2	216	16	160	0.1250	1.4E+00	4.0E-02	3.7E-04	No	No
	18000	0.0020	0.0260	2.0E-04	2	216	16	160	0.1250	1.4E+00	1.6E-02	1.5E-04	No	No
	30000	0.0010	0.0260	1.0E-04	2	216	16	160	0.1250	1.4E+00	8.0E-03	7.4E-05	No	No
	50000	0.0005	0.0260	5.0E-05	2	216	16	160	0.1250	1.4E+00	4.0E-03	3.7E-05	No	No
	50000+	0.0002	0.0260	2.0E-05	2	216	16	160	0.1250	1.4E+00	1.6E-03	1.5E-05	No	No
	50000++	0.0001	0.0260	1.0E-05	2	216	16	160	0.1250	1.4E+00	8.0E-04	7.4E-06	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990
**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Gray bat risk characterization for fog oil exposure under Pasquill Category E.

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Inhalation														
Musgrave Hollow														
Saltpeter #3	5447	0.0020	2.1E-10	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-04	1.0E-03	No	No
Freeman	13104	0.0005	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	0.0E+00	No	No
Bally McCann Hollow														
Saltpeter #3	2004	0.0100	1.0E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	4.8E-03	No	No
Freeman	12024	0.0005	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	0.0E+00	No	No
Mush Paddle Hollow														
Saltpeter #3	1751	0.0100	8.4E-10	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	4.0E-03	No	No
Freeman	16542	0.0005	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	0.0E+00	No	No
Ballard Hollow														
Saltpeter #3	13821	0.0005	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	0.0E+00	No	No
Freeman	11266	0.0005	0.0E+00	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m²)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Dermal Absorption														
Musgrave Hollow														
Saltpeter #3	5447	0.0100	0.026	1.0E-03	2	216	16	160	0.1250	1.4E+00	8.0E-02	7.4E-04	No	No
Freeman	13104	0.0020	0.026	2.0E-04	2	216	16	160	0.1250	1.4E+00	1.6E-02	1.5E-04	No	No
Bally McCann Hollow														
Saltpeter #3	2004	0.0100	0.026	7.5E-04	2	216	16	160	0.1250	1.4E+00	8.0E-02	5.5E-04	No	No
Freeman	12024	0.0020	0.026	1.5E-04	2	216	16	160	0.1250	1.4E+00	1.6E-02	1.1E-04	No	No
Mush Paddle Hollow														
Saltpeter #3	1751	0.0100	0.026	6.2E-04	2	216	16	160	0.1250	1.4E+00	8.0E-02	4.6E-04	No	No
Freeman	16542	0.0020	0.026	1.2E-04	2	216	16	160	0.1250	1.4E+00	1.6E-02	9.2E-05	No	No
Ballard Hollow														
Saltpeter #3	13821	0.0020	0.026	1.0E-04	2	216	16	160	0.1250	1.4E+00	1.6E-02	7.4E-05	No	No
Freeman	11266	0.0020	0.026	1.0E-04	2	216	16	160	0.1250	1.4E+00	1.6E-02	7.4E-05	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Attachment G: Terephthalic Acid (TPA) Grenades

Gray bat risk characterization for TPA exposure under Pasquill Category B.

TPA Smoke Grenade

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	3000	9.0E+00	1.3E-03	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	1.3E+01	Yes	Yes
	4000	5.0E-03	7.0E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	7.2E-03	No	No
	4000	2.0E-03	2.8E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	2.9E-03	No	No
	4000	1.0E-03	1.4E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	1.4E-03	No	No
	5000	5.0E-04	7.0E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	7.2E-04	No	No
	5000	2.0E-04	2.8E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	2.9E-04	No	No
	6000	1.0E-04	1.4E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	1.4E-04	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Inhalation														
	3000	9.0E+00	2.5E-03	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	2.6E+01	Yes	Yes
	4000	5.0E-03	1.4E-06	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	1.4E-02	No	No
	4000	2.0E-03	5.6E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	5.8E-03	No	No
	4000	1.0E-03	2.8E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	2.9E-03	No	No
	5000	5.0E-04	1.4E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	1.4E-03	No	No
	5000	2.0E-04	5.6E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	5.8E-04	No	No
	6000	1.0E-04	2.8E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	2.9E-04	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

Attachment G: TPA Smoke Pots

Gray bat risk characterization for TPA exposure under Pasquill Category B.

TPA Smoke Pots

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	3000	9.0E+00	3.8E-04	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	3.9E+00	Yes	Yes
	4000	5.0E-03	2.1E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	2.2E-03	No	No
	5000	2.0E-03	8.5E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	8.8E-04	No	No
	5000	1.0E-03	4.2E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	4.4E-04	No	No
	5000	5.0E-04	2.1E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	2.2E-04	No	No
	6000	2.0E-04	8.5E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	8.8E-05	No	No
	7000	1.0E-04	4.2E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	4.4E-05	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995
**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Inhalation														
	3000	9.0E+00	7.6E-04	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	7.9E+00	Yes	Yes
	4000	5.0E-03	4.2E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	4.4E-03	No	No
	5000	2.0E-03	1.7E-07	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	1.8E-03	No	No
	5000	1.0E-03	8.5E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	8.8E-04	No	No
	5000	5.0E-04	4.2E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	4.4E-04	No	No
	6000	2.0E-04	1.7E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	1.8E-04	No	No
	7000	1.0E-04	8.5E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	8.8E-05	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995
**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

Attachment G: Titanium Dioxide Grenades

Gray bat risk characterization for titanium dioxide exposure under Pasquill Category E.

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	100	1.0E-02	2.1E-08	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-02	4.1E-02	No	No
	300	5.0E-03	1.1E-08	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-02	2.0E-02	No	No
	500	2.0E-03	4.3E-09	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-03	8.1E-03	No	No
	700	1.0E-03	2.1E-09	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-03	4.1E-03	No	No
	1000	5.0E-04	1.1E-09	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-03	2.0E-03	No	No
	1400	2.0E-04	4.3E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-04	8.1E-04	No	No
	1800	1.0E-04	2.1E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-04	4.1E-04	No	No

*Acute toxicity value assumed equal to unadjusted chronic LOAEL. Acute critical effects are respiratory irritation. Critical Study: Lewis 1992

**Chronic critical effects are respiratory irritation. Critical Study: Lewis 1992

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Inhalation														
	100	1.0E-02	4.3E-08	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-02	8.1E-02	No	No
	300	5.0E-03	2.1E-08	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-02	4.1E-02	No	No
	500	2.0E-03	8.6E-09	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-03	1.6E-02	No	No
	700	1.0E-03	4.3E-09	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-03	8.1E-03	No	No
	1000	5.0E-04	2.1E-09	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-03	4.1E-03	No	No
	1400	2.0E-04	8.6E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-04	1.6E-03	No	No
	1800	1.0E-04	4.3E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-04	8.1E-04	No	No

*Acute toxicity value assumed equal to unadjusted chronic LOAEL. Acute critical effects are respiratory irritation. Critical Study: Lewis 1992

**Chronic critical effects are respiratory irritation. Critical Study: Lewis 1992

Attachment H
Risk Characterization - Bald Eagle

Attachment H: Fog Oil - Static Smoke

Bald eagle risk characterization for fog oil exposure under Pasquill Category B.

Static Smoke

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Inhalation														
	4000	1.0E-02	1.5E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-03	3.6E-03	No	No
	4000	5.0E-03	7.4E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-03	1.8E-03	No	No
	5000	2.0E-03	2.9E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-03	7.2E-04	No	No
	5000	1.0E-03	1.5E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-04	3.6E-04	No	No
	6000	5.0E-04	7.4E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-04	1.8E-04	No	No
	8000	2.0E-04	2.9E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	7.2E-05	No	No
	12000	1.0E-04	1.5E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	3.6E-05	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Ingestion													
	4000	1.1E-03	5.6E-04	17.6	22	32	3200	0.5500	6.9E-03	1.9E-03	8.2E-02	No	No
	5000	5.4E-04	2.8E-04	17.6	22	32	3200	0.5500	6.9E-03	9.7E-04	4.1E-02	No	No
	6000	2.1E-04	1.1E-04	17.6	22	32	3200	0.5500	6.9E-03	3.9E-04	1.7E-02	No	No
	7000	1.1E-04	5.7E-05	17.6	22	32	3200	0.5500	6.9E-03	1.9E-04	8.3E-03	No	No
	9500	5.4E-05	2.9E-05	17.6	22	32	3200	0.5500	6.9E-03	9.7E-05	4.2E-03	No	No
	14000	2.1E-05	1.1E-05	17.6	22	32	3200	0.5500	6.9E-03	3.9E-05	1.7E-03	No	No
	20000	1.1E-05	5.8E-06	17.6	22	32	3200	0.5500	6.9E-03	1.9E-05	8.4E-04	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Dermal Absorption														
	4000	1.0E-02	2.8E-01	4.9E-06	2	216	32	320	0.0625	6.8E-01	1.6E-01	7.3E-06	No	No
	5000	5.0E-03	2.8E-01	2.5E-06	2	216	32	320	0.0625	6.8E-01	8.0E-02	3.7E-06	No	No
	6000	2.0E-03	2.8E-01	9.9E-07	2	216	32	320	0.0625	6.8E-01	3.2E-02	1.5E-06	No	No
	7000	1.0E-03	2.8E-01	4.9E-07	2	216	32	320	0.0625	6.8E-01	1.6E-02	7.3E-07	No	No
	9500	5.0E-04	2.8E-01	2.5E-07	2	216	32	320	0.0625	6.8E-01	8.0E-03	3.7E-07	No	No
	14000	2.0E-04	2.8E-01	9.9E-08	2	216	32	320	0.0625	6.8E-01	3.2E-03	1.5E-07	No	No
	20000	1.0E-04	2.8E-01	4.9E-08	2	216	32	320	0.0625	6.8E-01	1.6E-03	7.3E-08	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects arewell defined erythema and edema. Critical Study: Lewis 1989

Bald eagle risk characterization for fog oil exposure under Pasquill Category B.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Inhalation														
South Nest	20229	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Mid Nest	23638	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
North Nest	45057	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Dermal Absorption														
South Nest	20229	1.0E-04	2.8E-01	6.9E-08	2	216	32	320	0.06	6.8E-01	1.6E-03	1.0E-07	No	No
Mid Nest	23638	0.0E+00	2.8E-01	0.0E+00	2	216	32	320	0.06	6.8E-01	0.0E+00	0.0E+00	No	No
North Nest	45057	0.0E+00	2.8E-01	0.0E+00	2	216	32	320	0.06	6.8E-01	0.0E+00	0.0E+00	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects arewell defined erythema and edema. Critical Study: Lewis 1989

Bald eagle risk characterization for fog oil exposure under Pasquill Category C.

Static Smoke

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Inhalation														
	3500	1.0E-02	1.5E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-03	3.6E-03	No	No
	3500	5.0E-03	7.4E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-03	1.8E-03	No	No
	4000	2.0E-03	2.9E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-03	7.2E-04	No	No
	5500	1.0E-03	1.5E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-04	3.6E-04	No	No
	7500	5.0E-04	7.4E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-04	1.8E-04	No	No
	12000	2.0E-04	2.9E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	7.2E-05	No	No
	18500	1.0E-04	1.5E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	3.6E-05	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Ingestion													
	3500	1.1E-03	5.6E-04	17.6	22	32	3200	0.5500	6.9E-03	1.9E-03	8.2E-02	No	No
	4000	5.4E-04	2.8E-04	17.6	22	32	3200	0.5500	6.9E-03	9.7E-04	4.1E-02	No	No
	5500	2.1E-04	1.1E-04	17.6	22	32	3200	0.5500	6.9E-03	3.9E-04	1.7E-02	No	No
	8000	1.1E-04	5.7E-05	17.6	22	32	3200	0.5500	6.9E-03	1.9E-04	8.3E-03	No	No
	12000	5.4E-05	2.9E-05	17.6	22	32	3200	0.5500	6.9E-03	9.7E-05	4.2E-03	No	No
	24000	2.1E-05	1.1E-05	17.6	22	32	3200	0.5500	6.9E-03	3.9E-05	1.7E-03	No	No
	40000	1.1E-05	5.8E-06	17.6	22	32	3200	0.5500	6.9E-03	1.9E-05	8.4E-04	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m²)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Dermal Absorption														
	3500	1.0E-02	2.8E-01	4.9E-06	2	216	32	320	0.0625	6.8E-01	1.6E-01	7.3E-06	No	No
	4000	5.0E-03	2.8E-01	2.5E-06	2	216	32	320	0.0625	6.8E-01	8.0E-02	3.7E-06	No	No
	5500	2.0E-03	2.8E-01	9.9E-07	2	216	32	320	0.0625	6.8E-01	3.2E-02	1.5E-06	No	No
	8000	1.0E-03	2.8E-01	4.9E-07	2	216	32	320	0.0625	6.8E-01	1.6E-02	7.3E-07	No	No
	12000	5.0E-04	2.8E-01	2.5E-07	2	216	32	320	0.0625	6.8E-01	8.0E-03	3.7E-07	No	No
	24000	2.0E-04	2.8E-01	9.9E-08	2	216	32	320	0.0625	6.8E-01	3.2E-03	1.5E-07	No	No
	40000	1.0E-04	2.8E-01	4.9E-08	2	216	32	320	0.0625	6.8E-01	1.6E-03	7.3E-08	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Bald eagle risk characterization for fog oil exposure under Pasquill Category C.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Inhalation														
South Nest	20229	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Mid Nest	23638	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
North Nest	45057	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Dermal Absorption														
South Nest	20229	2.0E-04	2.8E-01	1.4E-07	2	216	32	320	0.06	6.8E-01	3.2E-03	2.1E-07	No	No
Mid Nest	23638	2.0E-04	2.8E-01	1.4E-07	2	216	32	320	0.06	6.8E-01	3.2E-03	2.1E-07	No	No
North Nest	45057	0.0E+00	2.8E-01	0.0E+00	2	216	32	320	0.06	6.8E-01	0.0E+00	0.0E+00	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Bald eagle risk characterization for fog oil exposure under Pasquill Category D.

Static Smoke

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Inhalation														
	3500	1.0E-02	1.5E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-03	3.6E-03	No	No
	4500	5.0E-03	7.4E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-03	1.8E-03	No	No
	6500	2.0E-03	2.9E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-03	7.2E-04	No	No
	8500	1.0E-03	1.5E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-04	3.6E-04	No	No
	12500	5.0E-04	7.4E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-04	1.8E-04	No	No
	22500	2.0E-04	2.9E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	7.2E-05	No	No
	35500	1.0E-04	1.5E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	3.6E-05	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987
**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Ingestion													
	6500	1.1E-03	5.6E-04	17.6	22	32	3200	0.5500	6.9E-03	1.9E-03	8.2E-02	No	No
	8500	5.4E-04	2.8E-04	17.6	22	32	3200	0.5500	6.9E-03	9.7E-04	4.1E-02	No	No
	14000	2.1E-04	1.1E-04	17.6	22	32	3200	0.5500	6.9E-03	3.9E-04	1.7E-02	No	No
	22000	1.1E-04	5.7E-05	17.6	22	32	3200	0.5500	6.9E-03	1.9E-04	8.3E-03	No	No
	35500	5.4E-05	2.9E-05	17.6	22	32	3200	0.5500	6.9E-03	9.7E-05	4.2E-03	No	No
	50000+	2.1E-05	1.1E-05	17.6	22	32	3200	0.5500	6.9E-03	3.9E-05	1.7E-03	No	No
	50000++	1.1E-05	5.8E-06	17.6	22	32	3200	0.5500	6.9E-03	1.9E-05	8.4E-04	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958
**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Dermal Absorption														
	6500	1.0E-02	2.8E-01	4.9E-06	2	216	32	320	0.0625	6.8E-01	1.6E-01	7.3E-06	No	No
	8500	5.0E-03	2.8E-01	2.5E-06	2	216	32	320	0.0625	6.8E-01	8.0E-02	3.7E-06	No	No
	14000	2.0E-03	2.8E-01	9.9E-07	2	216	32	320	0.0625	6.8E-01	3.2E-02	1.5E-06	No	No
	22000	1.0E-03	2.8E-01	4.9E-07	2	216	32	320	0.0625	6.8E-01	1.6E-02	7.3E-07	No	No
	35500	5.0E-04	2.8E-01	2.5E-07	2	216	32	320	0.0625	6.8E-01	8.0E-03	3.7E-07	No	No
	50000+	2.0E-04	2.8E-01	9.9E-08	2	216	32	320	0.0625	6.8E-01	3.2E-03	1.5E-07	No	No
	50000++	1.0E-04	2.8E-01	4.9E-08	2	216	32	320	0.0625	6.8E-01	1.6E-03	7.3E-08	No	No

*Acute critical effects is slight to moderate skin irritation. Critical Study: Palmer 1990
**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Bald eagle risk characterization for fog oil exposure under Pasquill Category D.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Inhalation														
South Nest	20229	2.0E-04	4.1E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	1.0E-04	No	No
Mid Nest	23638	1.0E-04	2.1E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	5.0E-05	No	No
North Nest	45057	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Dermal Absorption														
South Nest	20229	1.0E-03	2.8E-01	6.9E-07	2	216	32	320	0.06	6.8E-01	1.6E-02	1.0E-06	No	No
Mid Nest	23638	5.0E-04	2.8E-01	3.5E-07	2	216	32	320	0.06	6.8E-01	8.0E-03	5.1E-07	No	No
North Nest	45057	2.0E-04	2.8E-01	1.4E-07	2	216	32	320	0.06	6.8E-01	3.2E-03	2.1E-07	No	No

*Acute critical effects is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Bald eagle risk characterization for fog oil exposure under Pasquill Category E.

Static Smoke

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Inhalation														
	4000	1.0E-02	1.5E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-03	3.6E-03	No	No
	5000	5.0E-03	7.4E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-03	1.8E-03	No	No
	9000	2.0E-03	2.9E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-03	7.2E-04	No	No
	14000	1.0E-03	1.5E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-04	3.6E-04	No	No
	24000	5.0E-04	7.4E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-04	1.8E-04	No	No
	50000	2.0E-04	2.9E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	7.2E-05	No	No
	50000+	1.0E-04	1.5E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	3.6E-05	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Ingestion													
	7500	1.1E-03	5.6E-04	17.6	22	32	3200	0.5500	6.9E-03	1.9E-03	8.2E-02	No	No
	10000	5.4E-04	2.8E-04	17.6	22	32	3200	0.5500	6.9E-03	9.7E-04	4.1E-02	No	No
	18000	2.1E-04	1.1E-04	17.6	22	32	3200	0.5500	6.9E-03	3.9E-04	1.7E-02	No	No
	30000	1.1E-04	5.7E-05	17.6	22	32	3200	0.5500	6.9E-03	1.9E-04	8.3E-03	No	No
	50000	5.4E-05	2.9E-05	17.6	22	32	3200	0.5500	6.9E-03	9.7E-05	4.2E-03	No	No
	50000+	2.1E-05	1.1E-05	17.6	22	32	3200	0.5500	6.9E-03	3.9E-05	1.7E-03	No	No
	50000++	1.1E-05	5.8E-06	17.6	22	32	3200	0.5500	6.9E-03	1.9E-05	8.4E-04	No	No

*Acute critical effects are weight loss and lesions of theliver, splen, and kidney. Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m²)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Dermal Absorption														
	7500	1.0E-02	2.8E-01	4.9E-06	2	216	32	320	0.0625	6.8E-01	1.6E-01	7.3E-06	No	No
	10000	5.0E-03	2.8E-01	2.5E-06	2	216	32	320	0.0625	6.8E-01	8.0E-02	3.7E-06	No	No
	18000	2.0E-03	2.8E-01	9.9E-07	2	216	32	320	0.0625	6.8E-01	3.2E-02	1.5E-06	No	No
	30000	1.0E-03	2.8E-01	4.9E-07	2	216	32	320	0.0625	6.8E-01	1.6E-02	7.3E-07	No	No
	50000	5.0E-04	2.8E-01	2.5E-07	2	216	32	320	0.0625	6.8E-01	8.0E-03	3.7E-07	No	No
	50000+	2.0E-04	2.8E-01	9.9E-08	2	216	32	320	0.0625	6.8E-01	3.2E-03	1.5E-07	No	No
	50000++	1.0E-04	2.8E-01	4.9E-08	2	216	32	320	0.0625	6.8E-01	1.6E-03	7.3E-08	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Bald eagle risk characterization for fog oil exposure under Pasquill Category E.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Inhalation														
South Nest	20229	5.0E-04	1.0E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-04	2.5E-04	No	No
Mid Nest	23638	5.0E-04	1.0E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-04	2.5E-04	No	No
North Nest	45057	2.0E-04	4.1E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	1.0E-04	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Dermal Absorption														
South Nest	20229	1.0E-03	2.8E-01	6.9E-07	2	216	32	320	0.06	6.8E-01	1.6E-02	1.0E-06	No	No
Mid Nest	23638	1.0E-03	2.8E-01	6.9E-07	2	216	32	320	0.06	6.8E-01	1.6E-02	1.0E-06	No	No
North Nest	45057	5.0E-04	2.8E-01	3.5E-07	2	216	32	320	0.06	6.8E-01	8.0E-03	5.1E-07	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Attachment H: Fog Oil - Mobile Smoke

Bald eagle risk characterization for fog oil exposure under Pasquill Category E.

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Inhalation														
Musgrave Hollow														
South Nest	25174	2.0E-04	2.5E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	6.0E-04	No	No
Mid Nest	27956	2.0E-04	2.5E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	6.0E-04	No	No
North Nest	48211	1.0E-04	1.2E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	3.0E-04	No	No
Bally McCann Hollow														
South Nest	19717	2.0E-04	1.8E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	4.5E-04	No	No
Mid Nest	23623	2.0E-04	1.8E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	4.5E-04	No	No
North Nest	44956	1.0E-04	9.2E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	2.2E-04	No	No
Mush Paddle Hollow														
South Nest	20749	2.0E-04	1.5E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	3.7E-04	No	No
Mid Nest	28050	2.0E-04	1.5E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	3.7E-04	No	No
North Nest	49712	1.0E-04	7.7E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	1.9E-04	No	No
Ballard Hollow														
South Nest	17463	2.0E-04	1.2E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	3.0E-04	No	No
Mid Nest	11677	5.0E-04	3.1E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-04	7.6E-04	No	No
North Nest	34057	1.0E-04	6.1E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	1.5E-04	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m³)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Dermal Absorption														
Musgrave Hollow														
South Nest	25174	1.0E-03	2.8E-01	3.4E-06	2	216	32	320	0.06	6.8E-01	1.6E-02	5.1E-06	No	No
Mid Nest	27956	1.0E-03	2.8E-01	2.5E-06	2	216	32	320	0.06	6.8E-01	1.6E-02	3.7E-06	No	No
North Nest	48211	5.0E-04	2.8E-01	1.2E-06	2	216	32	320	0.06	6.8E-01	8.0E-03	1.8E-06	No	No
Bally McCann Hollow														
South Nest	19717	1.0E-03	2.8E-01	1.9E-06	2	216	32	320	0.06	6.8E-01	1.6E-02	2.7E-06	No	No
Mid Nest	23623	1.0E-03	2.8E-01	1.9E-06	2	216	32	320	0.06	6.8E-01	1.6E-02	2.7E-06	No	No
North Nest	44956	4.0E-04	2.8E-01	7.4E-07	2	216	32	320	0.06	6.8E-01	6.4E-03	1.1E-06	No	No
Mush Paddle Hollow														
South Nest	20749	1.0E-03	2.8E-01	1.5E-06	2	216	32	320	0.06	6.8E-01	1.6E-02	2.3E-06	No	No
Mid Nest	28050	2.0E-03	2.8E-01	3.1E-06	2	216	32	320	0.06	6.8E-01	3.2E-02	4.6E-06	No	No
North Nest	49712	5.0E-04	2.8E-01	7.7E-07	2	216	32	320	0.06	6.8E-01	8.0E-03	1.1E-06	No	No
Ballard Hollow														
South Nest	17463	2.0E-03	2.8E-01	2.5E-06	2	216	32	320	0.06	6.8E-01	3.2E-02	3.7E-06	No	No
Mid Nest	11677	2.0E-03	2.8E-01	2.5E-06	2	216	32	320	0.06	6.8E-01	3.2E-02	3.7E-06	No	No
North Nest	34057	5.0E-04	2.8E-01	6.2E-07	2	216	32	320	0.06	6.8E-01	8.0E-03	9.2E-07	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Bald eagle risk characterization for fog oil exposure under Pasquill Category E.

Mobile Smoke

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Inhalation														
	3000	1.0E-02	8.8E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-03	2.1E-02	No	No
	4000	5.0E-03	4.4E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-03	1.1E-02	No	No
	7000	2.0E-03	1.8E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-03	4.3E-03	No	No
	10000	1.0E-03	8.8E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-04	2.1E-03	No	No
	16000	5.0E-04	4.4E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-04	1.1E-03	No	No
	30000	2.0E-04	1.8E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	4.3E-04	No	No
	50000	1.0E-04	8.8E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	2.1E-04	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987
**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Ingestion													
	7500	1.1E-03	2.0E-03	17.6	22	32	3200	0.55	6.9E-03	1.9E-03	2.9E-01	No	No
	10000	5.4E-04	1.0E-03	17.6	22	32	3200	0.55	6.9E-03	9.7E-04	1.5E-01	No	No
	18000	2.1E-04	4.1E-04	17.6	22	32	3200	0.55	6.9E-03	3.9E-04	5.9E-02	No	No
	30000	1.1E-04	2.0E-04	17.6	22	32	3200	0.55	6.9E-03	1.9E-04	3.0E-02	No	No
	50000	5.4E-05	1.0E-04	17.6	22	32	3200	0.55	6.9E-03	9.7E-05	1.5E-02	No	No
	50000+	2.1E-05	4.1E-05	17.6	22	32	3200	0.55	6.9E-03	3.9E-05	6.0E-03	No	No
	50000++	1.1E-05	2.1E-05	17.6	22	32	3200	0.55	6.9E-03	1.9E-05	3.0E-03	No	No

*Acute critical effects are weight loss and lesions of theliver, splen, and kidney. Critical Study: Bramachari 1958
**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Dermal Absorption														
	7500	1.0E-02	2.8E-01	1.8E-05	2	216	32	320	0.06	6.8E-01	1.6E-01	2.6E-05	No	No
	10000	5.0E-03	2.8E-01	8.8E-06	2	216	32	320	0.06	6.8E-01	8.0E-02	1.3E-05	No	No
	18000	2.0E-03	2.8E-01	3.5E-06	2	216	32	320	0.06	6.8E-01	3.2E-02	5.2E-06	No	No
	30000	1.0E-03	2.8E-01	1.8E-06	2	216	32	320	0.06	6.8E-01	1.6E-02	2.6E-06	No	No
	50000	5.0E-04	2.8E-01	8.8E-07	2	216	32	320	0.06	6.8E-01	8.0E-03	1.3E-06	No	No
	50000+	2.0E-04	2.8E-01	3.5E-07	2	216	32	320	0.06	6.8E-01	3.2E-03	5.2E-07	No	No
	50000++	1.0E-04	2.8E-01	1.8E-07	2	216	32	320	0.06	6.8E-01	1.6E-03	2.6E-07	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990
**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Bald eagle risk characterization for fog oil exposure under Pasquill Category D.

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Inhalation														
Musgrave Hollow														
South Nest	25174	1.0E-04	1.2E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	3.0E-04	No	No
Mid Nest	27956	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
North Nest	48211	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Baily McCann Hollow														
South Nest	19717	1.0E-04	9.2E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	2.2E-04	No	No
Mid Nest	23623	1.0E-04	9.2E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	2.2E-04	No	No
North Nest	44956	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Mush Paddle Hollow														
South Nest	20749	1.0E-04	7.7E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	1.9E-04	No	No
Mid Nest	28050	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
North Nest	49712	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Ballard Hollow														
South Nest	17463	1.0E-04	6.1E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	1.5E-04	No	No
Mid Nest	11677	2.0E-04	1.2E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	3.0E-04	No	No
North Nest	34057	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m²)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Dermal Absorption														
Musgrave Hollow														
South Nest	25174	5.0E-04	2.8E-01	1.7E-06	2	216	32	320	0.06	6.8E-01	8.0E-03	2.5E-06	No	No
Mid Nest	27956	5.0E-04	2.8E-01	1.2E-06	2	216	32	320	0.06	6.8E-01	8.0E-03	1.8E-06	No	No
North Nest	48211	2.0E-04	2.8E-01	4.9E-07	2	216	32	320	0.06	6.8E-01	3.2E-03	7.3E-07	No	No
Baily McCann Hollow														
South Nest	19717	1.0E-03	2.8E-01	1.9E-06	2	216	32	320	0.06	6.8E-01	1.6E-02	2.7E-06	No	No
Mid Nest	23623	5.0E-04	2.8E-01	9.3E-07	2	216	32	320	0.06	6.8E-01	8.0E-03	1.4E-06	No	No
North Nest	44956	2.0E-04	2.8E-01	3.7E-07	2	216	32	320	0.06	6.8E-01	3.2E-03	5.5E-07	No	No
Mush Paddle Hollow														
South Nest	20749	1.0E-03	2.8E-01	1.5E-06	2	216	32	320	0.06	6.8E-01	1.6E-02	2.3E-06	No	No
Mid Nest	28050	5.0E-04	2.8E-01	7.7E-07	2	216	32	320	0.06	6.8E-01	8.0E-03	1.1E-06	No	No
North Nest	49712	2.0E-04	2.8E-01	3.1E-07	2	216	32	320	0.06	6.8E-01	3.2E-03	4.6E-07	No	No
Ballard Hollow														
South Nest	17463	1.0E-04	2.8E-01	1.2E-07	2	216	32	320	0.06	6.8E-01	1.6E-03	1.8E-07	No	No
Mid Nest	11677	2.0E-03	2.8E-01	2.5E-06	2	216	32	320	0.06	6.8E-01	3.2E-02	3.7E-06	No	No
North Nest	34057	5.0E-04	2.8E-01	6.2E-07	2	216	32	320	0.06	6.8E-01	8.0E-03	9.2E-07	No	No

*Acute critical effects is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Bald eagle risk characterization for fog oil exposure under Pasquill Category D.

Mobile Smoke

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Inhalation														
	2500	1.0E-02	8.8E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-03	2.1E-02	No	No
	3000	5.0E-03	4.4E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-03	1.1E-02	No	No
	4500	2.0E-03	1.8E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-03	4.3E-03	No	No
	6000	1.0E-03	8.8E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-04	2.1E-03	No	No
	9500	5.0E-04	4.4E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-04	1.1E-03	No	No
	16500	2.0E-04	1.8E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	4.3E-04	No	No
	26500	1.0E-04	8.8E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	2.1E-04	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987
**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Ingestion													
	6500	1.1E-03	2.0E-03	17.6	22	32	3200	0.55	6.9E-03	1.9E-03	2.9E-01	No	No
	8500	5.4E-04	1.0E-03	17.6	22	32	3200	0.55	6.9E-03	9.7E-04	1.5E-01	No	No
	14500	2.1E-04	4.1E-04	17.6	22	32	3200	0.55	6.9E-03	3.9E-04	5.9E-02	No	No
	22000	1.1E-04	2.0E-04	17.6	22	32	3200	0.55	6.9E-03	1.9E-04	3.0E-02	No	No
	35500	5.4E-05	1.0E-04	17.6	22	32	3200	0.55	6.9E-03	9.7E-05	1.5E-02	No	No
	50000+	2.1E-05	4.1E-05	17.6	22	32	3200	0.55	6.9E-03	3.9E-05	6.0E-03	No	No
	50000++	1.1E-05	2.1E-05	17.6	22	32	3200	0.55	6.9E-03	1.9E-05	3.0E-03	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958
**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m²)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Dermal Absorption														
	6500	1.0E-02		1.8E-05	2	216	32	320	0.06	6.8E-01	1.6E-01	2.6E-05	No	No
	8500	5.0E-03		8.8E-06	2	216	32	320	0.06	6.8E-01	8.0E-02	1.3E-05	No	No
	14500	2.0E-03		3.5E-06	2	216	32	320	0.06	6.8E-01	3.2E-02	5.2E-06	No	No
	22000	1.0E-03		1.8E-06	2	216	32	320	0.06	6.8E-01	1.6E-02	2.6E-06	No	No
	35500	5.0E-04		8.8E-07	2	216	32	320	0.06	6.8E-01	8.0E-03	1.3E-06	No	No
	50000+	2.0E-04		3.5E-07	2	216	32	320	0.06	6.8E-01	3.2E-03	5.2E-07	No	No
	50000++	1.0E-04		1.8E-07	2	216	32	320	0.06	6.8E-01	1.6E-03	2.6E-07	No	No

*Acute critical effects is slight to moderate skin irritation. Critical Study: Palmer 1990
**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Bald eagle risk characterization for fog oil exposure under Pasquill Category C.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Inhalation														
Musgrave Hollow														
South Nest	25174	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Mid Nest	27956	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
North Nest	48211	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Baily McCann Hollow														
South Nest	19717	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Mid Nest	23623	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
North Nest	44956	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Mush Paddle Hollow														
South Nest	20749	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Mid Nest	28050	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
North Nest	49712	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Ballard Hollow														
South Nest	17463	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Mid Nest	11677	1.0E-04	6.1E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	1.5E-04	No	No
North Nest	34057	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Dermal Absorption														
Musgrave Hollow														
South Nest	25174	1.0E-04	2.8E-01	8.6E-07	2	216	32	320	0.06	6.8E-01	1.6E-03	1.3E-06	No	No
Mid Nest	27956	1.0E-04	2.8E-01	2.5E-07	2	216	32	320	0.06	6.8E-01	1.6E-03	3.7E-07	No	No
North Nest	48211	1.0E-04	2.8E-01	2.5E-07	2	216	32	320	0.06	6.8E-01	1.6E-03	3.7E-07	No	No
Baily McCann Hollow														
South Nest	19717	2.0E-04	2.8E-01	3.7E-07	2	216	32	320	0.06	6.8E-01	3.2E-03	5.5E-07	No	No
Mid Nest	23623	2.0E-04	2.8E-01	3.7E-07	2	216	32	320	0.06	6.8E-01	3.2E-03	5.5E-07	No	No
North Nest	44956	0.0E+00	2.8E-01	0.0E+00	2	216	32	320	0.06	6.8E-01	0.0E+00	0.0E+00	No	No
Mush Paddle Hollow														
South Nest	20749	5.0E-04	2.8E-01	7.7E-07	2	216	32	320	0.06	6.8E-01	8.0E-03	1.1E-06	No	No
Mid Nest	28050	1.0E-04	2.8E-01	1.5E-07	2	216	32	320	0.06	6.8E-01	1.6E-03	2.3E-07	No	No
North Nest	49712	0.0E+00	2.8E-01	0.0E+00	2	216	32	320	0.06	6.8E-01	0.0E+00	0.0E+00	No	No
Ballard Hollow														
South Nest	17463	2.0E-04	2.8E-01	2.5E-07	2	216	32	320	0.06	6.8E-01	3.2E-03	3.7E-07	No	No
Mid Nest	11677	5.0E-04	2.8E-01	6.2E-07	2	216	32	320	0.06	6.8E-01	8.0E-03	9.2E-07	No	No
North Nest	34057	1.0E-04	2.8E-01	1.2E-07	2	216	32	320	0.06	6.8E-01	1.6E-03	1.8E-07	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Bald eagle risk characterization for fog oil exposure under Pasquill Category C.

Mobile Smoke

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Inhalation														
	3000	1.0E-02	8.8E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-03	2.1E-02	No	No
	3000	5.0E-03	4.4E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-03	1.1E-02	No	No
	3000	2.0E-03	1.8E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-03	4.3E-03	No	No
	4500	1.0E-03	8.8E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-04	2.1E-03	No	No
	6500	5.0E-04	4.4E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-04	1.1E-03	No	No
	9500	2.0E-04	1.8E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	4.3E-04	No	No
	14000	1.0E-04	8.8E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	2.1E-04	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Ingestion													
	3000	1.1E-03	2.0E-03	17.6	22	32	3200	0.55	6.9E-03	1.9E-03	2.9E-01	No	No
	4000	5.4E-04	1.0E-03	17.6	22	32	3200	0.55	6.9E-03	9.7E-04	1.5E-01	No	No
	5000	2.1E-04	4.1E-04	17.6	22	32	3200	0.55	6.9E-03	3.9E-04	5.9E-02	No	No
	8500	1.1E-04	2.0E-04	17.6	22	32	3200	0.55	6.9E-03	1.9E-04	3.0E-02	No	No
	12000	5.4E-05	1.0E-04	17.6	22	32	3200	0.55	6.9E-03	9.7E-05	1.5E-02	No	No
	24000	2.1E-05	4.1E-05	17.6	22	32	3200	0.55	6.9E-03	3.9E-05	6.0E-03	No	No
	40000	1.1E-05	2.1E-05	17.6	22	32	3200	0.55	6.9E-03	1.9E-05	3.0E-03	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Dermal Absorption														
	3000	1.0E-02	2.8E-01	1.8E-05	2	216	32	320	0.06	6.8E-01	1.6E-01	2.6E-05	No	No
	4000	5.0E-03	2.8E-01	8.8E-06	2	216	32	320	0.06	6.8E-01	8.0E-02	1.3E-05	No	No
	5000	2.0E-03	2.8E-01	3.5E-06	2	216	32	320	0.06	6.8E-01	3.2E-02	5.2E-06	No	No
	8500	1.0E-03	2.8E-01	1.8E-06	2	216	32	320	0.06	6.8E-01	1.6E-02	2.6E-06	No	No
	12000	5.0E-04	2.8E-01	8.8E-07	2	216	32	320	0.06	6.8E-01	8.0E-03	1.3E-06	No	No
	24000	2.0E-04	2.8E-01	3.5E-07	2	216	32	320	0.06	6.8E-01	3.2E-03	5.2E-07	No	No
	40000	1.0E-04	2.8E-01	1.8E-07	2	216	32	320	0.06	6.8E-01	1.6E-03	2.6E-07	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Bald eagle risk characterization for fog oil exposure under Pasquill Category B.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Inhalation														
Musgrave Hollow														
South Nest	25174	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Mid Nest	27956	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
North Nest	48211	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Bally McCann Hollow														
South Nest	19717	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Mid Nest	23623	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
North Nest	44956	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Mush Paddle Hollow														
South Nest	20749	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Mid Nest	28050	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
North Nest	49712	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Ballard Hollow														
South Nest	17463	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
Mid Nest	11677	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No
North Nest	34057	0.0E+00	0.0E+00	60	0.1	32	320	1.88	3.1E-04	4.1E-04	0.0E+00	0.0E+00	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Dermal Absorption														
Musgrave Hollow														
South Nest	25174	0.0E+00	2.8E-01	0.0E+00	2	216	32	320	0.06	6.8E-01	0.0E+00	0.0E+00	No	No
Mid Nest	27956	0.0E+00	2.8E-01	0.0E+00	2	216	32	320	0.06	6.8E-01	0.0E+00	0.0E+00	No	No
North Nest	48211	0.0E+00	2.8E-01	0.0E+00	2	216	32	320	0.06	6.8E-01	0.0E+00	0.0E+00	No	No
Bally McCann Hollow														
South Nest	19717	1.0E-04	2.8E-01	1.9E-07	2	216	32	320	0.06	6.8E-01	1.6E-03	2.7E-07	No	No
Mid Nest	23623	0.0E+00	2.8E-01	0.0E+00	2	216	32	320	0.06	6.8E-01	0.0E+00	0.0E+00	No	No
North Nest	44956	0.0E+00	2.8E-01	0.0E+00	2	216	32	320	0.06	6.8E-01	0.0E+00	0.0E+00	No	No
Mush Paddle Hollow														
South Nest	20749	0.0E+00	2.8E-01	0.0E+00	2	216	32	320	0.06	6.8E-01	0.0E+00	0.0E+00	No	No
Mid Nest	28050	0.0E+00	2.8E-01	0.0E+00	2	216	32	320	0.06	6.8E-01	0.0E+00	0.0E+00	No	No
North Nest	49712	0.0E+00	2.8E-01	0.0E+00	2	216	32	320	0.06	6.8E-01	0.0E+00	0.0E+00	No	No
Ballard Hollow														
South Nest	17463	1.0E-04	2.8E-01	1.2E-07	2	216	32	320	0.06	6.8E-01	1.6E-03	1.8E-07	No	No
Mid Nest	11677	2.0E-04	2.8E-01	2.5E-07	2	216	32	320	0.06	6.8E-01	3.2E-03	3.7E-07	No	No
North Nest	34057	0.0E+00	2.8E-01	0.0E+00	2	216	32	320	0.06	6.8E-01	0.0E+00	0.0E+00	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects arewell defined erythema and edema. Critical Study: Lewis 1989

Bald eagle risk characterization for fog oil exposure under Pasquill Category B.

Mobile Smoke

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Inhalation														
	4000	1.0E-02	8.8E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-03	2.1E-02	No	No
	4000	5.0E-03	4.4E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-03	1.1E-02	No	No
	4000	2.0E-03	1.8E-06	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-03	4.3E-03	No	No
	5000	1.0E-03	8.8E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-04	2.1E-03	No	No
	5000	5.0E-04	4.4E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-04	1.1E-03	No	No
	7000	2.0E-04	1.8E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	4.3E-04	No	No
	9000	1.0E-04	8.8E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	2.1E-04	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Ingestion													
	4000	1.1E-03	2.0E-03	17.6	22	32	3200	0.55	6.9E-03	1.9E-03	2.9E-01	No	No
	5000	5.4E-04	1.0E-03	17.6	22	32	3200	0.55	6.9E-03	9.7E-04	1.5E-01	No	No
	6000	2.1E-04	4.1E-04	17.6	22	32	3200	0.55	6.9E-03	3.9E-04	5.9E-02	No	No
	7500	1.1E-04	2.0E-04	17.6	22	32	3200	0.55	6.9E-03	1.9E-04	3.0E-02	No	No
	9500	5.4E-05	1.0E-04	17.6	22	32	3200	0.55	6.9E-03	9.7E-05	1.5E-02	No	No
	14500	2.1E-05	4.1E-05	17.6	22	32	3200	0.55	6.9E-03	3.9E-05	6.0E-03	No	No
	20000	1.1E-05	2.1E-05	17.6	22	32	3200	0.55	6.9E-03	1.9E-05	3.0E-03	No	No

*Acute critical effects are weight loss and lesions of the liver, spleen, and kidney. Critical Study: Bramachari 1958

**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Dermal Absorption														
	4000	1.0E-02		1.8E-05	2	216	32	320	0.06	6.8E-01	1.6E-01	2.6E-05	No	No
	5000	5.0E-03		8.8E-06	2	216	32	320	0.06	6.8E-01	8.0E-02	1.3E-05	No	No
	6000	2.0E-03		3.5E-06	2	216	32	320	0.06	6.8E-01	3.2E-02	5.2E-06	No	No
	7500	1.0E-03		1.8E-06	2	216	32	320	0.06	6.8E-01	1.6E-02	2.6E-06	No	No
	9500	5.0E-04		8.8E-07	2	216	32	320	0.06	6.8E-01	8.0E-03	1.3E-06	No	No
	14500	2.0E-04		3.5E-07	2	216	32	320	0.06	6.8E-01	3.2E-03	5.2E-07	No	No
	20000	1.0E-04		1.8E-07	2	216	32	320	0.06	6.8E-01	1.6E-03	2.6E-07	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects arewell defined erythema and edema. Critical Study: Lewis 1989

Attachment H: Terephthalic Acid (TPA) Grenades

Bald eagle risk characterization for TPA exposure under Pasquill Category B.

TPA Smoke Grenade	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	*Acute Effect	Chronic Effect
Winter Inhalation														
	3000	9.0E+00	3.0E-06	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	3.3E+01	1.0E+00	Yes	No
	4000	5.0E-03	1.7E-09	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	1.9E-02	5.6E-04	No	No
	4000	2.0E-03	6.7E-10	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	7.4E-03	2.2E-04	No	No
	4000	1.0E-03	3.4E-10	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	3.7E-03	1.1E-04	No	No
	5000	5.0E-04	1.7E-10	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	1.9E-03	5.6E-05	No	No
	5000	2.0E-04	6.7E-11	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	7.4E-04	2.2E-05	No	No
	6000	1.0E-04	3.4E-11	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	3.7E-04	1.1E-05	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

Attachment H: TPA Smoke Pots

Bald eagle risk characterization for TPA exposure under Pasquill Category B.

TPA Smoke Pot	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Inhalation														
	3000	9.0E+00	1.3E-06	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	3.3E+01	4.2E-01	Yes	No
	4000	5.0E-03	7.1E-10	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	1.9E-02	2.4E-04	No	No
	5000	2.0E-03	2.8E-10	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	7.4E-03	9.4E-05	No	No
	5000	1.0E-03	1.4E-10	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	3.7E-03	4.7E-05	No	No
	5000	5.0E-04	7.1E-11	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	1.9E-03	2.4E-05	No	No
	6000	2.0E-04	2.8E-11	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	7.4E-04	9.4E-06	No	No
	7000	1.0E-04	1.4E-11	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	3.7E-04	4.7E-06	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

Attachment H: Titanium Dioxide Grenades

Bald eagle risk characterization for titanium dioxide exposure under Pasquill Category E.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Inhalation														
	100	1.0E-02	1.0E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-02	1.9E-04	No	No
	300	5.0E-03	5.0E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-02	9.5E-05	No	No
	500	2.0E-03	2.0E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-03	3.8E-05	No	No
	700	1.0E-03	1.0E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-03	1.9E-05	No	No
	1000	5.0E-04	5.0E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-03	9.5E-06	No	No
	1400	2.0E-04	2.0E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-04	3.8E-06	No	No
	1800	1.0E-04	1.0E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-04	1.9E-06	No	No

*Acute toxicity value assumed equal to unadjusted chronic LOAEL. Acute critical effects are respiratory irritation. Critical Study: Lewis 1992
**Chronic critical effects are respiratory irritation. Critical Study: Lewis 1992

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Inhalation														
	100	1.0E-02	7.2E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-02	1.4E-04	No	No
	300	5.0E-03	3.6E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-02	6.8E-05	No	No
	500	2.0E-03	1.4E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-03	2.7E-05	No	No
	700	1.0E-03	7.2E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-03	1.4E-05	No	No
	1000	5.0E-04	3.6E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-03	6.8E-06	No	No
	1400	2.0E-04	1.4E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-04	2.7E-06	No	No
	1800	1.0E-04	7.2E-13	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-04	1.4E-06	No	No

*Acute toxicity value assumed equal to unadjusted chronic LOAEL. Acute critical effects are respiratory irritation. Critical Study: Lewis 1992
**Chronic critical effects are respiratory irritation. Critical Study: Lewis 1992

Attachment I
Threshold Values for Titanium Dioxide, Terephthalic Acid, and Fog Oil

TABLE I-1. TIO_2 threshold values for Indiana bats, gray bats, and bald eagles.

Receptor Activity	Time of Year	Effect	Distance/ Location of Effect	Threshold Value
Foraging & roosting Indiana bats		None		521
Hibernating Indiana bats		None		388
Gray bats		None		
Bald eagles		None		

TABLE I-2. TPA grenade threshold values for Indiana bats, gray bats, and bald eagles.

Receptor Activity	Time of Year	Effect	Distance/ Location of Effect	Threshold Value
Foraging & roosting Indiana bats	1 May through 31 August	Acute Inhalation	Within 3000 m of 22 TAs	0
Foraging & roosting Indiana bats	1 May through 31 August	Chronic Inhalation	Within 3000 m of 22 TAs	105
Hibernating Indiana bats	1 September through 30 April	Acute Inhalation	Davis No. 2 and Joy from Sapper TA, Joy Cave from Range 28 Wolf Den from TA243, TA238, and Road Brooks from TA125, TA194	0
Hibernating Indiana bats	1 September through 30 April	Chronic Inhalation	Davis No. 2 and Joy from Sapper TA, Joy Cave from Range 28 Wolf Den from TA243, TA238, and Road Brooks from TA125, TA194	105

TABLE I-2. Continued.

Receptor Activity	Time of Year	Effect	Distance/ Location of Effect	Threshold Value
Foraging gray bats	1 April through 31 October, 1 hr before sunset to 1 hr after sunrise	Acute Inhalation	Within 3000 m of any of the 22 TAs	0
Foraging gray bats	1 April through 31 October, 1 hr before sunset to 1 hr after sunrise	Chronic Inhalation	Within 3000 m of any of the 22 TAs	120
Gray bats in maternity caves	1 April through 31 October	Acute Inhalation	Saltpeter No. 3 from Sapper TA	0
Gray bats in maternity caves	1 April through 31 October	Chronic Inhalation	Saltpeter No. 3 from Sapper TA	120

TABLE I-2. Continued.

Receptor Activity	Time of Year	Effect	Distance/ Location of Effect	Threshold Value
Traveling bald eagles	1 November through 15 March	Acute Inhalation	Within 3000 m of any of the 22 TAs	0
Perching bald eagles	1 November through 15 March	Chronic Inhalation	Roubidoux Creek from TA 240S, TA 241, R 28, TA 234, Sapper TA, Road Big Piney River from TA 126, TA 125, TA 194	2242
Nesting bald eagles		None		

TABLE I-3. TPA smoke pots threshold values for Indiana bats, gray bats, and bald eagles.

Receptor Activity	Time of Year	Effect	Distance/ Location of Effect	Threshold Value
Foraging & roosting Indiana bats	1 May through 31 August	Acute Inhalation	Within 3000 m of 9 TAs	0
Foraging & roosting Indiana bats	1 May through 31 August	Chronic Inhalation	Within 3000 m of 22 TAs	107
Hibernating Indiana bats	1 September through 30 April	Acute Inhalation	Davis No. 2 and Joy from Mush Paddle & Bailey McCann Wolf Den from R33	0
Hibernating Indiana bats	1 September through 30 April	Chronic Inhalation	Davis No. 2 and Joy from Mush Paddle & Bailey McCann Wolf Den from R33	79
Foraging gray bats	1 April through 31 October, 1 hr before sunset to 1 hr after sunrise	Acute Inhalation	Within 3000 m of any of the 9 TAs	0
Foraging gray bats	1 April through 31 October, 1 hr before sunset to 1 hr after sunrise	Chronic Inhalation	Within 3000 m of any of the 9 TAs	120
Gray bats in maternity caves	1 April through 31 October	Acute inhalation	Saltpeter No. 3 from Mush Paddle, Bailey McCann	0
Gray bats in maternity caves	1 April through 31 October	Chronic inhalation	Saltpeter No. 3 from Mush Paddle, Bailey McCann	120

TABLE I-3. Continued.

Receptor Activity	Time of Year	Effect	Distance/ Location of Effect	Threshold Value
Traveling bald eagles	1 November through 15 March	Acute Inhalation	Within 3000 m of any of the 9 TAs	0
Perching bald eagles	1 November through 15 March	Chronic Inhalation	Roubidoux Creek from Mush Paddle, Bailey McCann, Musgrave, FP6, & R28	1114
Nesting bald eagles		None		

TABLE I-4. Quantity of fog oil used in the determination of effects to Indiana bats, gray bats, and bald eagles for the RCP Alternative. Annual consumption of fog oil for static is 20,000 gallons and mobile training is 105,500 gallons. The percent of time (gallons) each mobile smoke training area will be used is provided.

Receptor Activity	Gallons of Fog Oil				
	Static	Ballard Hollow (20%)	Cannon Range (Mush Paddle Hollow) (25%)	Musgrave Hollow (40%)	Bailey/ McCann Hollow (30%)
Hibernating Indiana bats	20,000	21,100	26,375	42,200	31,650
Foraging/ roosting Indiana bats	20,000	42,200	42,200	42,200	42,200
Gray bats in maternity caves	20,000	21,100	26,375	42,200	31,650
Foraging Gray bats	20,000	42,200	42,200	42,200	42,200
Traveling Bald Eagles	20,000	42,200	42,200	42,200	42,200
Perching Bald Eagles	20,000	42,200	42,200	42,200	42,200
Nesting Bald Eagles	20,000	42,200	42,200	42,200	42,200

TABLE I-5. Quantity of fog oil used in the determination of effects to Indiana bats, gray bats, and bald eagles for the OPTM Alternative. Annual consumption of fog oil for static is 8,500 gallons and for mobile training is 76,000 gallons. The percent of time (gallons) each mobile smoke training area will be used is provided.

Receptor Activity	Gallons of Fog Oil				
	Static	Ballard Hollow (20%)	Cannon Range (Mush Paddle Hollow) (25%)	Musgrave Hollow (40%)	Bailey/ McCann Hollow (30%)
Hibernating Indiana bats	8500	15,200	19,000	30,400	22,800
Foraging/ roosting Indiana bats	8500	30,400	30,400	30,400	30,400
Gray bats in maternity caves	8500	15,200	19,000	30,400	22,800
Foraging Gray bats	8500	30,400	30,400	30,400	30,400
Perching & Traveling Bald Eagles	8500	30,400	30,400	30,400	30,400
Perching Bald Eagles	8500	30,400	30,400	30,400	30,400
Nesting Bald Eagles	8500	30,400	30,400	30,400	30,400

TABLE I-6. Quantity of fog oil used in the determination of effects to Indiana bats, gray bats, and bald eagles for the EPTM Alternative. Annual consumption of fog oil for static is 500 gallons and mobile training is 49,000 gallons. The percent of time (gallons) each mobile smoke training area will be used is provided.

Receptor Activity	Gallons of Fog Oil				
	Static	Ballard Hollow (20%)	Cannon Range (Mush Paddle Hollow) (25%)	Musgrave Hollow (40%)	Bailey/ McCann Hollow (30%)
Hibernating Indiana bats	500	9800	12,250	19,600	14,700
Foraging/ roosting Indiana bats	500	19,600	19,600	19,600	19,600
Gray bats in maternity caves	500	9800	12,250	19,600	14,700
Foraging gray bats	500	19,600	19,600	19,600	19,600
Traveling bald eagles	500	19,600	19,600	19,600	19,600
Perching bald eagles	500	19,600	19,600	19,600	19,600
Nesting bald eagles	500	19,600	19,600	19,600	19,600

TABLE I-7. Effects predicted for foraging and roosting summer Indiana bats from RCP, OPTM, and EPTM Training Alternatives based on percentage of use on mobile TAs.

Receptor Activity	Effect Based on Percent Use	Pasquill Category	Distance of Effect (m)		
			RCP	OPTM	EPTM
Foraging/ roosting	Chronic Inhalation	B	4000	4000	4000
		C	3500	3000	3000
		D	6000	4500	3000
		E	10,000	7000	4000

TABLE I-8. Effects predicted for hibernating winter Indiana bats from RCP, OPTM, and EPTM Training Alternatives based on percentage of use on mobile fog oil TAs.

Mobile Fog Oil Training Area	Pasquill Category	Hibernacula Affected		
		RCP	OPTM	EPTM
Musgrave Hollow	B, C, D, and E	None	None	None
Cannon Range (Mush Paddle Hollow)	B	Davis No. 2 and Joy	Davis No.2 and Joy	Davis No.2 and Joy
	C	Davis No.2 and Joy	Davis No.2 and Joy	Davis No.2 and Joy
	D	Davis No.2 and Joy	Davis No.2 and Joy	Davis No.2 and Joy
	E	Davis No.2 and Joy	Davis No.2 and Joy	Davis No.2 and Joy
Bailey McCann Hollow	B	Davis No.2 Wolf Den, and Joy	Davis No.2 Wolf Den, and Joy	Davis No.2 Wolf Den, and Joy
	C	Davis No.2 and Joy	Davis No.2 and Joy	Davis No.2 and Joy
	D	Davis No.2 and Joy	Davis No.2 and Joy	Davis No.2 and Joy
	E	Davis No.2 Wolf Den, and Joy	Davis No.2 Wolf Den, and Joy	Davis No.2 Wolf Den, and Joy
Ballard		None	None	None

TABLE I-9. Effects predicted for foraging gray bats from RCP, OPTM, and EPTM Training Alternatives based on percentage of use on mobile fog oil TAs.

Receptor Activity	Effect Based on Percent Use	Pasquill Category	Distance of Effect (m)		
			RCP	OPTM	EPTM
Foraging	Chronic Inhalation	B	4000	4000	4000
		C	3000	3000	3000
		D	4500	4500	3000
		E	7000	7000	4000

TABLE I-10. RCP, OPTM, and EPTM Training Alternatives chronic inhalation effects to gray bats in maternity colonies in caves based on percentage of use at each mobile fog oil TA.

Mobile Fog Oil Training Area	Pasquill Category	Cave Affected		
		RCP	OPTM	EPTM
Musgrave Hollow	B	Saltpeter No. 3	Saltpeter No. 3	None
	C	Saltpeter No. 3	None	None
	D	None	None	None
	E	Saltpeter No. 3	None	None
Cannon Range (Mush Paddle Hollow)	B	Saltpeter No. 3	Saltpeter No. 3	Saltpeter No. 3
	C	Saltpeter No. 3	Saltpeter No. 3	Saltpeter No. 3
	D	None	None	None
	E	Saltpeter No. 3	None	None
Bailey/McCann Hollow	B	Saltpeter No. 3	Saltpeter No. 3	Saltpeter No. 3
	C	Saltpeter No. 3	Saltpeter No. 3	Saltpeter No. 3
	D	None	None	None
	E	Saltpeter No. 3	None	None
Ballard Hollow	B, C, D. & E	None	None	None

Attachment J
Stressor Intake and Risk Characterization Sensitive Life Stages for Indiana Bats, Gray Bats, and Bald Eagles

RISK PARAMETERS FOR INDIANA BATS

Summer Foraging/Roosting Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Daily Chronic Intake Value		Amount of stressor taken in by the receptor, averaged over its lifetime, per day.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Chronic Dose Adjusted Toxicity Reference Value	Chronic Dose Adjusted TRV	A toxicological value adjusted by multiplicative uncertainty factors for chronic (averaged over the receptor's lifespan) exposure.
Acute Hazard Quotient		Equal to expected exposure $concentration_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $intake_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

RISK PARAMETERS FOR GRAY BATS

Summer Foraging Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Daily Chronic Intake Value		Amount of stressor taken in by the receptor, averaged over its lifetime, per day.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Chronic Dose Adjusted Toxicity Reference Value	Chronic Dose Adjusted TRV	A toxicological value adjusted by multiplicative uncertainty factors for chronic (averaged over the receptor's lifespan) exposure.
Acute Hazard Quotient		Equal to expected exposure $concentration_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $intake_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

Maternity Cave Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Daily Chronic Intake Value		Amount of stressor taken in by the receptor, averaged over its lifetime, per day.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Chronic Dose Adjusted Toxicity Reference Value	Chronic Dose Adjusted TRV	A toxicological value adjusted by multiplicative uncertainty factors for chronic (averaged over the receptor's lifespan) exposure.
Acute Hazard Quotient		Equal to expected exposure $concentration_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $intake_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

RISK PARAMETERS FOR BALD EAGLES

Summer Foraging Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Daily Chronic Intake Value		Amount of stressor taken in by the receptor, averaged over its lifetime, per day.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Chronic Dose Adjusted Toxicity Reference Value	Chronic Dose Adjusted TRV	A toxicological value adjusted by multiplicative uncertainty factors for chronic (averaged over the receptor's lifespan) exposure.
Acute Hazard Quotient		Equal to expected exposure $concentration_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $intake_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

Summer Foraging Ingestion

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Daily Chronic Intake Value		Amount of stressor taken in by the receptor, averaged over its lifetime, per day.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Acute Hazard Quotient		Equal to expected exposure $concentration_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $intake_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

RISK PARAMETERS FOR BALD EAGLES

Summer Foraging Dermal Absorption

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Skin Surface Area		Surface area of receptor.
Dermally Absorbed Dose		Amount of chemical stressor dermally absorbed by receptor.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Acute Hazard Quotient		Equal to expected exposure $concentration_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $intake_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

Maternity Cave Inhalation

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Daily Chronic Intake Value		Amount of stressor taken in by the receptor, averaged over its lifetime, per day.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Chronic Dose Adjusted Toxicity Reference Value	Chronic Dose Adjusted TRV	A toxicological value adjusted by multiplicative uncertainty factors for chronic (averaged over the receptor's lifespan) exposure.
Acute Hazard Quotient		Equal to expected exposure $concentration_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $intake_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

RISK PARAMETERS FOR BALD EAGLES

Maternity Cave Dermal Absorption

Parameter	Abbreviation	Definition
Distance		Number of meters from chemical source to exposure point.
Daily Acute Intake Value		Amount of stressor taken in by the receptor per day.
Skin Surface Area		Surface area of receptor.
Dermally Absorbed Dose		Amount of chemical stressor dermally absorbed by receptor.
Acute Toxicity Value		Single chemical exposure.
Chronic Toxicity Value		Chemical exposure averaged over the receptor's lifetime.
Acute Toxicity Reference Value Uncertainty Adjustment	Acute TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors).
Chronic Toxicity Reference Value Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Multiplicative factors applied to toxicological values to account for uncertainty in morphological and physiological differences between test species and species of concern (receptors), averaged over the receptor's lifetime.
Acute Toxicity Reference Value	Acute TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints. A TRV was developed for each receptor.
Chronic Toxicity Reference Value	Chronic TRV	Adjusted (with uncertainty factors) toxicological reference values used as measurement endpoints, averaged over the receptors lifetime. A TRV was developed for each receptor.
Acute Hazard Quotient		Equal to expected exposure $concentration_{acute}$ divided by TRV_{acute}.
Chronic Hazard Quotient		Equal to daily $intake_{chronic}$ divided by $TRV_{chronic}$.
Acute Effect		Acute Effect = yes, if Acute Hazard Quotient>1. Acute Effect = no, if Acute Hazard Quotient <1.
Chronic Effect		Chronic Effect = yes, if Chronic Hazard Quotient>1. Chronic Effect = no, if Chronic Hazard Quotient<1.

Attachment J: Fog Oil - Nursing Indiana Bats

Mobile Smoke															
	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation														
	3000	1.0E-02	1.8E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	8.7E-02	No	No
	4000	5.0E-03	9.2E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	4.4E-02	No	No
	7000	2.0E-03	3.7E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	1.7E-02	No	No
	10000	1.0E-03	1.8E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	8.7E-03	No	No
	16000	5.0E-04	9.2E-10	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	4.4E-03	No	No
	30000	2.0E-04	3.7E-10	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	1.7E-03	No	No
	50000	1.0E-04	1.8E-10	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	8.7E-04	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

Pasquill Category E

Static Smoke

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation														
	4000	1.0E-02	6.2E-10	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	2.9E-03	No	No
	5000	5.0E-03	3.1E-10	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	1.5E-03	No	No
	9000	2.0E-03	1.2E-10	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	5.9E-04	No	No
	14000	1.0E-03	6.2E-11	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	2.9E-04	No	No
	24000	5.0E-04	3.1E-11	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	1.5E-04	No	No
	50000	2.0E-04	1.2E-11	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	5.9E-05	No	No
	50000+	1.0E-04	6.2E-12	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	2.9E-05	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

Mobile Smoke							nursing pups			
	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	3000	0.01	3.4E-04	1.4E-05	3.5E-05	16.3	0.049	0.006	2555	1.8E-08
	4000	0.005	3.4E-04	1.4E-05	3.5E-05	16.3	0.049	0.006	2555	9.2E-09
	7000	0.002	3.4E-04	1.4E-05	3.5E-05	16.3	0.049	0.006	2555	3.7E-09
	10000	0.001	3.4E-04	1.4E-05	3.5E-05	16.3	0.049	0.006	2555	1.8E-09
	16000	0.0005	3.4E-04	1.4E-05	3.5E-05	16.3	0.049	0.006	2555	9.2E-10
	30000	0.0002	3.4E-04	1.4E-05	3.5E-05	16.3	0.049	0.006	2555	3.7E-10
	50000	0.0001	3.4E-04	1.4E-05	3.5E-05	16.3	0.049	0.006	2555	1.8E-10

Static Smoke						EF (days/yr)	nursing pups			
	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	4000	0.01	3.4E-04	1.4E-05	2.1E-05	0.9	0.049	0.006	2555	6.2E-10
	5000	0.005	3.4E-04	1.4E-05	2.1E-05	0.9	0.049	0.006	2555	3.1E-10
	9000	0.002	3.4E-04	1.4E-05	2.1E-05	0.9	0.049	0.006	2555	1.2E-10
	14000	0.001	3.4E-04	1.4E-05	2.1E-05	0.9	0.049	0.006	2555	6.2E-11
	24000	0.0005	3.4E-04	1.4E-05	2.1E-05	0.9	0.049	0.006	2555	3.1E-11
	50000	0.0002	3.4E-04	1.4E-05	2.1E-05	0.9	0.049	0.006	2555	1.2E-11
	50000+	0.0001	3.4E-04	1.4E-05	2.1E-05	0.9	0.049	0.006	2555	6.2E-12

Attachment J: Fog Oil - Supplemented Nursing Indiana Bats

Static Smoke								supplemented nursing			
	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	4000	0.01	3.4E-04	1.4E-05	2.1E-05	0.9	0.074	0.007	2555	8.0E-10
	5000	0.005	3.4E-04	1.4E-05	2.1E-05	0.9	0.074	0.007	2555	4.0E-10
	9000	0.002	3.4E-04	1.4E-05	2.1E-05	0.9	0.074	0.007	2555	1.6E-10
	14000	0.001	3.4E-04	1.4E-05	2.1E-05	0.9	0.074	0.007	2555	8.0E-11
	24000	0.0005	3.4E-04	1.4E-05	2.1E-05	0.9	0.074	0.007	2555	4.0E-11
	50000	0.0002	3.4E-04	1.4E-05	2.1E-05	0.9	0.074	0.007	2555	1.6E-11
	50000+	0.0001	3.4E-04	1.4E-05	2.1E-05	0.9	0.074	0.007	2555	8.0E-12

Mobile Smoke	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	3000	0.01	3.4E-04	1.4E-05	3.5E-05	16.3	0.074	0.007	2555	2.4E-08
	4000	0.005	3.4E-04	1.4E-05	3.5E-05	16.3	0.074	0.007	2555	1.2E-08
	7000	0.002	3.4E-04	1.4E-05	3.5E-05	16.3	0.074	0.007	2555	4.7E-09
	10000	0.001	3.4E-04	1.4E-05	3.5E-05	16.3	0.074	0.007	2555	2.4E-09
	16000	0.0005	3.4E-04	1.4E-05	3.5E-05	16.3	0.074	0.007	2555	1.2E-09
	30000	0.0002	3.4E-04	1.4E-05	3.5E-05	16.3	0.074	0.007	2555	4.7E-10
	50000	0.0001	3.4E-04	1.4E-05	3.5E-05	16.3	0.074	0.007	2555	2.4E-10

Static Smoke

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation														
	4000	1.0E-02	8.0E-10	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	3.8E-03	No	No
	5000	5.0E-03	4.0E-10	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	1.9E-03	No	No
	9000	2.0E-03	1.6E-10	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	7.6E-04	No	No
	14000	1.0E-03	8.0E-11	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	3.8E-04	No	No
	24000	5.0E-04	4.0E-11	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	1.9E-04	No	No
	50000	2.0E-04	1.6E-11	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	7.6E-05	No	No
	50000+	1.0E-04	8.0E-12	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	3.8E-05	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

Mobile Smoke	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation														
	3000	1.0E-02	2.4E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-03	1.1E-01	No	No
	4000	5.0E-03	1.2E-08	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-03	5.6E-02	No	No
	7000	2.0E-03	4.7E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-04	2.3E-02	No	No
	10000	1.0E-03	2.4E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-04	1.1E-02	No	No
	16000	5.0E-04	1.2E-09	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	1.3E-04	5.6E-03	No	No
	30000	2.0E-04	4.7E-10	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	5.3E-05	2.3E-03	No	No
	50000	1.0E-04	2.4E-10	60	0.1	16	160	3.8E+00	6.3E-04	2.1E-07	2.7E-05	1.1E-03	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

Attachment J: Fog Oil - Nursing Gray Bats

Static Smoke										
	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging Inhalation										
	4000	0.01	3.4E-04	1.4E-05	2.1E-05	0.9	0.055	0.0054	3650	5.4E-10
	5000	0.005	3.4E-04	1.4E-05	2.1E-05	0.9	0.055	0.0054	3650	2.7E-10
	9000	0.002	3.4E-04	1.4E-05	2.1E-05	0.9	0.055	0.0054	3650	1.1E-10
	14000	0.001	3.4E-04	1.4E-05	2.1E-05	0.9	0.055	0.0054	3650	5.4E-11
	24000	0.0005	3.4E-04	1.4E-05	2.1E-05	0.9	0.055	0.0054	3650	2.7E-11
	50000	0.0002	3.4E-04	1.4E-05	2.1E-05	0.9	0.055	0.0054	3650	1.1E-11
	50000+	0.0001	3.4E-04	1.4E-05	2.1E-05	0.9	0.055	0.0054	3650	5.4E-12

Pasquill Category E

Mobile Smoke	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging Inhalation										
	3000	0.01	3.4E-04	1.4E-05	3.5E-05	16.3	0.055	0.0054	3650	1.6E-08
	4000	0.005	3.4E-04	1.4E-05	3.5E-05	16.3	0.055	0.0054	3650	8.0E-09
	7000	0.002	3.4E-04	1.4E-05	3.5E-05	16.3	0.055	0.0054	3650	3.2E-09
	10000	0.001	3.4E-04	1.4E-05	3.5E-05	16.3	0.055	0.0054	3650	1.6E-09
	16000	0.0005	3.4E-04	1.4E-05	3.5E-05	16.3	0.055	0.0054	3650	8.0E-10
	30000	0.0002	3.4E-04	1.4E-05	3.5E-05	16.3	0.055	0.0054	3650	3.2E-10
	50000	0.0001	3.4E-04	1.4E-05	3.5E-05	16.3	0.055	0.0054	3650	1.6E-10

Static Smoke	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	4000	0.0100	5.4E-10	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	2.6E-03	No	No
	5000	0.0050	2.7E-10	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-03	1.3E-03	No	No
	9000	0.0020	1.1E-10	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-04	5.1E-04	No	No
	14000	0.0010	5.4E-11	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	2.6E-04	No	No
	24000	0.0005	2.7E-11	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	1.3E-04	No	No
	50000	0.0002	1.1E-11	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	5.1E-05	No	No
	50000+	0.0001	5.4E-12	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	2.6E-05	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

Mobile Smoke	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	3000	0.0100	1.6E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	7.6E-02	No	No
	4000	0.0050	8.0E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-03	3.8E-02	No	No
	7000	0.0020	3.2E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-04	1.5E-02	No	No
	10000	0.0010	1.6E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	7.6E-03	No	No
	16000	0.0005	8.0E-10	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	3.8E-03	No	No
	30000	0.0002	3.2E-10	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	1.5E-03	No	No
	50000	0.0001	1.6E-10	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	7.6E-04	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

Attachment J: Fog Oil - Supplemented Nursing Gray Bats

Static Smoke							supplemented nursing			
	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging Inhalation										
	4000	0.01	3.4E-04	1.4E-05	2.1E-05	0.9	0.123	0.0071	3650	9.2E-10
	5000	0.005	3.4E-04	1.4E-05	2.1E-05	0.9	0.123	0.0071	3650	4.6E-10
	9000	0.002	3.4E-04	1.4E-05	2.1E-05	0.9	0.123	0.0071	3650	1.8E-10
	14000	0.001	3.4E-04	1.4E-05	2.1E-05	0.9	0.123	0.0071	3650	9.2E-11
	24000	0.0005	3.4E-04	1.4E-05	2.1E-05	0.9	0.123	0.0071	3650	4.6E-11
	50000	0.0002	3.4E-04	1.4E-05	2.1E-05	0.9	0.123	0.0071	3650	1.8E-11
	50000+	0.0001	3.4E-04	1.4E-05	2.1E-05	0.9	0.123	0.0071	3650	9.2E-12

Mobile Smoke										
	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging Inhalation										
	3000	0.01	3.4E-04	1.4E-05	3.5E-05	16.3	0.123	0.0071	3650	2.7E-08
	4000	0.005	3.4E-04	1.4E-05	3.5E-05	16.3	0.123	0.0071	3650	1.4E-08
	7000	0.002	3.4E-04	1.4E-05	3.5E-05	16.3	0.123	0.0071	3650	5.4E-09
	10000	0.001	3.4E-04	1.4E-05	3.5E-05	16.3	0.123	0.0071	3650	2.7E-09
	16000	0.0005	3.4E-04	1.4E-05	3.5E-05	16.3	0.123	0.0071	3650	1.4E-09
	30000	0.0002	3.4E-04	1.4E-05	3.5E-05	16.3	0.123	0.0071	3650	5.4E-10
	50000	0.0001	3.4E-04	1.4E-05	3.5E-05	16.3	0.123	0.0071	3650	2.7E-10

Static Smoke	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	4000	0.0100	9.2E-10	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	4.4E-03	No	No
	5000	0.0050	4.6E-10	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-03	2.2E-03	No	No
	9000	0.0020	1.8E-10	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-04	8.7E-04	No	No
	14000	0.0010	9.2E-11	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	4.4E-04	No	No
	24000	0.0005	4.6E-11	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	2.2E-04	No	No
	50000	0.0002	1.8E-11	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	8.7E-05	No	No
	50000+	0.0001	9.2E-12	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	4.4E-05	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

Mobile Smoke	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	3000	0.0100	2.7E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-03	1.3E-01	No	No
	4000	0.0050	1.4E-08	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-03	6.5E-02	No	No
	7000	0.0020	5.4E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-04	2.6E-02	No	No
	10000	0.0010	2.7E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-04	1.3E-02	No	No
	16000	0.0005	1.4E-09	60	0.1	16	160	3.75	6.3E-04	2.1E-07	1.3E-04	6.5E-03	No	No
	30000	0.0002	5.4E-10	60	0.1	16	160	3.75	6.3E-04	2.1E-07	5.3E-05	2.6E-03	No	No
	50000	0.0001	2.7E-10	60	0.1	16	160	3.75	6.3E-04	2.1E-07	2.7E-05	1.3E-03	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

Attachment J: Fog Oil - Bald Eagle Eggs

Static Smoke									
	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Dermal Absorption									
South Nest	20229	0.001	0.0108	1	0.9	0.096	0.12	12775	6.2E-10
Mid Nest	23638	0.001	0.0108	1	0.9	0.096	0.12	12775	6.2E-10
North Nest	45057	0.0005	0.0108	1	0.9	0.096	0.12	12775	3.1E-10

Mobile Smoke									
	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Summer Dermal Absorption									
Musgrave Hollow									
South Nest	25174	0.001	0.0108	1	16.3	0.096	0.12	12775	1.1E-08
Mid Nest	27956	0.001	0.0108	1	16.3	0.096	0.12	12775	1.1E-08
North Nest	48211	0.0005	0.0108	1	16.3	0.096	0.12	12775	5.5E-09
Baily McCann Hollow									
South Nest	19717	0.001	0.0108	1	12.3	0.096	0.12	12775	8.3E-09
Mid Nest	23623	0.001	0.0108	1	12.3	0.096	0.12	12775	8.3E-09
North Nest	44956	0.0004	0.0108	1	12.3	0.096	0.12	12775	3.3E-09
Mush Paddle Hollow									
South Nest	20749	0.001	0.0108	1	10.2	0.096	0.12	12775	6.9E-09
Mid Nest	28050	0.002	0.0108	1	10.2	0.096	0.12	12775	1.4E-08
North Nest	49712	0.0005	0.0108	1	10.2	0.096	0.12	12775	3.5E-09
Ballard Hollow									
South Nest	17463	0.002	0.0108	1	8.2	0.096	0.12	12775	1.1E-08
Mid Nest	11677	0.002	0.0108	1	8.2	0.096	0.12	12775	1.1E-08
North Nest	34057	0.0005	0.0108	1	8.2	0.096	0.12	12775	2.8E-09

Static Smoke	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Dermal Absorption														
South Nest	20229	1.0E-03	1.1E-02	6.2E-10	2	216	32	320	0.06	6.8E-01	1.6E-02	9.2E-10	No	No
Mid Nest	23638	1.0E-03	1.1E-02	6.2E-10	2	216	32	320	0.06	6.8E-01	1.6E-02	9.2E-10	No	No
North Nest	45057	5.0E-04	1.1E-02	3.1E-10	2	216	32	320	0.06	6.8E-01	8.0E-03	4.6E-10	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Mobile Smoke	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Dermal Absorption														
Musgrave Hollow														
South Nest	25174	1.0E-03	1.1E-02	2.4E-08	2	216	32	320	0.06	6.8E-01	1.6E-02	3.5E-08	No	No
Mid Nest	27956	1.0E-03	1.1E-02	1.1E-08	2	216	32	320	0.06	6.8E-01	1.6E-02	1.6E-08	No	No
North Nest	48211	5.0E-04	1.1E-02	5.5E-09	2	216	32	320	0.06	6.8E-01	8.0E-03	8.2E-09	No	No
Baily McCann Hollow														
South Nest	19717	1.0E-03	1.1E-02	8.3E-09	2	216	32	320	0.06	6.8E-01	1.6E-02	1.2E-08	No	No
Mid Nest	23623	1.0E-03	1.1E-02	8.3E-09	2	216	32	320	0.06	6.8E-01	1.6E-02	1.2E-08	No	No
North Nest	44956	4.0E-04	1.1E-02	3.3E-09	2	216	32	320	0.06	6.8E-01	6.4E-03	4.9E-09	No	No
Mush Paddle Hollow														
South Nest	20749	1.0E-03	1.1E-02	6.9E-09	2	216	32	320	0.06	6.8E-01	1.6E-02	1.0E-08	No	No
Mid Nest	28050	2.0E-03	1.1E-02	1.4E-08	2	216	32	320	0.06	6.8E-01	3.2E-02	2.0E-08	No	No
North Nest	49712	5.0E-04	1.1E-02	3.5E-09	2	216	32	320	0.06	6.8E-01	8.0E-03	5.1E-09	No	No
Ballard Hollow														
South Nest	17463	2.0E-03	1.1E-02	1.1E-08	2	216	32	320	0.06	6.8E-01	3.2E-02	1.6E-08	No	No
Mid Nest	11677	2.0E-03	1.1E-02	1.1E-08	2	216	32	320	0.06	6.8E-01	3.2E-02	1.6E-08	No	No
North Nest	34057	5.0E-04	1.1E-02	2.8E-09	2	216	32	320	0.06	6.8E-01	8.0E-03	4.1E-09	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990

**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Attachment J: Fog Oil - Hatchling Bald Eagles

Static Smoke	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Inhalation										
South Nest	20229	0.0005	0.24	0.010	0.015	0.9	0.027	0.5	12775	2.9E-11
Mid Nest	23638	0.0005	0.24	0.010	0.015	0.9	0.027	0.5	12775	2.9E-11
North Nest	45057	0.0002	0.24	0.010	0.015	0.9	0.027	0.5	12775	1.2E-11

Mobile Smoke	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Inhalation										
Musgrave Hollow										
South Nest	25174	0.0002	0.24	0.010	0.025	16.3	0.027	0.5	12775	3.5E-10
Mid Nest	27956	0.0002	0.24	0.010	0.025	16.3	0.027	0.5	12775	3.5E-10
North Nest	48211	0.0001	0.24	0.010	0.025	16.3	0.027	0.5	12775	1.7E-10
Bally McCann Hollow										
South Nest	19717	0.0002	0.24	0.010	0.025	12.3	0.027	0.5	12775	2.6E-10
Mid Nest	23623	0.0002	0.24	0.010	0.025	12.3	0.027	0.5	12775	2.6E-10
North Nest	44956	0.0001	0.24	0.010	0.025	12.3	0.027	0.5	12775	1.3E-10
Mush Paddle Hollow										
South Nest	20749	0.0002	0.24	0.010	0.025	10.2	0.027	0.5	12775	2.2E-10
Mid Nest	28050	0.0002	0.24	0.010	0.025	10.2	0.027	0.5	12775	2.2E-10
North Nest	49712	0.0001	0.24	0.010	0.025	10.2	0.027	0.5	12775	1.1E-10
Ballard Hollow										
South Nest	17463	0.0002	0.24	0.010	0.025	8.2	0.027	0.5	12775	1.7E-10
Mid Nest	11677	0.0005	0.24	0.010	0.025	8.2	0.027	0.5	12775	4.3E-10
North Nest	34057	0.0001	0.24	0.010	0.025	8.2	0.027	0.5	12775	8.6E-11

Pasquill Category E

Static Smoke	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Inhalation														
South Nest	20229	5.0E-04	2.9E-11	60	0.1	32	320	1.88	3.1E-04	7.5E-05	2.7E-04	3.9E-07	No	No
Mid Nest	23638	5.0E-04	2.9E-11	60	0.1	32	320	1.88	3.1E-04	7.5E-05	2.7E-04	3.9E-07	No	No
North Nest	45057	2.0E-04	1.2E-11	60	0.1	32	320	1.88	3.1E-04	7.5E-05	1.1E-04	1.5E-07	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

Mobile Smoke	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Inhalation														
Musgrave Hollow														
South Nest	25174	2.0E-04	3.5E-10	60	0.1	32	320	1.88	3.1E-04	7.5E-05	1.1E-04	4.6E-06	No	No
Mid Nest	27956	2.0E-04	3.5E-10	60	0.1	32	320	1.88	3.1E-04	7.5E-05	1.1E-04	4.6E-06	No	No
North Nest	48211	1.0E-04	1.7E-10	60	0.1	32	320	1.88	3.1E-04	7.5E-05	5.3E-05	2.3E-06	No	No
Baily McCann Hollow														
South Nest	19717	2.0E-04	2.6E-10	60	0.1	32	320	1.88	3.1E-04	7.5E-05	1.1E-04	3.5E-06	No	No
Mid Nest	23623	2.0E-04	2.6E-10	60	0.1	32	320	1.88	3.1E-04	7.5E-05	1.1E-04	3.5E-06	No	No
North Nest	44956	1.0E-04	1.3E-10	60	0.1	32	320	1.88	3.1E-04	7.5E-05	5.3E-05	1.7E-06	No	No
Mush Paddle Hollow														
South Nest	20749	2.0E-04	2.2E-10	60	0.1	32	320	1.88	3.1E-04	7.5E-05	1.1E-04	2.9E-06	No	No
Mid Nest	28050	2.0E-04	2.2E-10	60	0.1	32	320	1.88	3.1E-04	7.5E-05	1.1E-04	2.9E-06	No	No
North Nest	49712	1.0E-04	1.1E-10	60	0.1	32	320	1.88	3.1E-04	7.5E-05	5.3E-05	1.4E-06	No	No
Ballard Hollow														
South Nest	17463	2.0E-04	1.7E-10	60	0.1	32	320	1.88	3.1E-04	7.5E-05	1.1E-04	2.3E-06	No	No
Mid Nest	11677	5.0E-04	4.3E-10	60	0.1	32	320	1.88	3.1E-04	7.5E-05	2.7E-04	5.8E-06	No	No
North Nest	34057	1.0E-04	8.6E-11	60	0.1	32	320	1.88	3.1E-04	7.5E-05	5.3E-05	1.2E-06	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987

**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

Attachment J: Fog Oil - Juvenile Bald Eagles

Static Smoke								Juveniles			
	Distance (m)	Fog Oil Concentration (g/m^3)		Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
				Daily IR	Hourly IR	Event IR					
Winter Inhalation											
	4000	0.01		1.31	0.055	0.082	0.9	2	4.5	12775	2.6E-08
	5000	0.005		1.31	0.055	0.082	0.9	2	4.5	12775	1.3E-08
	9000	0.002		1.31	0.055	0.082	0.9	2	4.5	12775	5.2E-09
	14000	0.001		1.31	0.055	0.082	0.9	2	4.5	12775	2.6E-09
	24000	0.0005		1.31	0.055	0.082	0.9	2	4.5	12775	1.3E-09
	50000	0.0002		1.31	0.055	0.082	0.9	2	4.5	12775	5.2E-10
	50000+	0.0001		1.31	0.055	0.082	0.9	2	4.5	12775	2.6E-10
	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
Winter Ingestion											
	7500	0.01	0.0874	0.815	0.0011	292.5	0.9	2	4.5	12775	1.0E-05
	10000	0.005	0.0874	0.815	0.0005	293.5	0.9	2	4.5	12775	5.0E-06
	18000	0.002	0.0874	0.815	0.0002	294.5	0.9	2	4.5	12775	2.0E-06
	30000	0.001	0.0874	0.815	0.0001	295.5	0.9	2	4.5	12775	1.0E-06
	50000	0.0005	0.0874	0.815	0.0001	296.5	0.9	2	4.5	12775	5.1E-07
	50000+	0.0002	0.0874	0.815	0.0000	297.5	0.9	2	4.5	12775	2.0E-07
	50000++	0.0001	0.0874	0.815	0.0000	298.5	0.9	2	4.5	12775	1.0E-07
	Distance (m)	Fog Oil Concentration (g/m^2)		Skin Surface Area (m^2)		ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Dermal Absorption											
	7500	0.01		0.275		1	0.9	2	4.5	12775	8.8E-08
	10000	0.005		0.275		1	0.9	2	4.5	12775	4.4E-08
	18000	0.002		0.275		1	0.9	2	4.5	12775	1.8E-08
	30000	0.001		0.275		1	0.9	2	4.5	12775	8.8E-09
	50000	0.0005		0.275		1	0.9	2	4.5	12775	4.4E-09
	50000+	0.0002		0.275		1	0.9	2	4.5	12775	1.8E-09
	50000++	0.0001		0.275		1	0.9	2	4.5	12775	8.8E-10

Bald eagle juv intake, EPTM

Mobile Smoke								juveniles			
	Distance (m)	Fog Oil Concentration (g/m^3)	Intake Rate (m^3/day)			EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)	
			Daily IR	Hourly IR	Event IR						
Winter Inhalation											
	3000	0.01	1.31	0.055	0.136	16.3	2	4.5	12775	7.8E-07	
	4000	0.005	1.31	0.055	0.136	16.3	2	4.5	12775	3.9E-07	
	7000	0.002	1.31	0.055	0.136	16.3	2	4.5	12775	1.6E-07	
	10000	0.001	1.31	0.055	0.136	16.3	2	4.5	12775	7.8E-08	
	16000	0.0005	1.31	0.055	0.136	16.3	2	4.5	12775	3.9E-08	
	30000	0.0002	1.31	0.055	0.136	16.3	2	4.5	12775	1.6E-08	
	50000	0.0001	1.31	0.055	0.136	16.3	2	4.5	12775	7.8E-09	

	Distance (m)	Fog Oil Deposition (g/m^2)	Prey SA (m^2)	Prey Weight (g)	CF (g/g)	Intake Rate (g/day)	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
						Daily IR					
Winter Ingestion											
	7500	0.01	0.0874	0.815	0.0011	292.5	16.3	2	4.5	12775	1.8E-04
	10000	0.005	0.0874	0.815	0.0005	293.5	16.3	2	4.5	12775	8.9E-05
	18000	0.002	0.0874	0.815	0.0002	294.5	16.3	2	4.5	12775	3.6E-05
	30000	0.001	0.0874	0.815	0.0001	295.5	16.3	2	4.5	12775	1.8E-05
	50000	0.0005	0.0874	0.815	0.0001	296.5	16.3	2	4.5	12775	9.0E-06
	50000+	0.0002	0.0874	0.815	0.0000	297.5	16.3	2	4.5	12775	3.6E-06
	50000++	0.0001	0.0874	0.815	0.0000	298.5	16.3	2	4.5	12775	1.8E-06

	Distance (m)	Fog Oil Concentration (g/m^2)	Skin Surface Area (m^2)	ABS	EF (days/yr)	ED (yrs)	BW (kg)	AT (days)	Dermally Absorbed Dose (g/kg-day)
Winter Dermal Absorption									
	7500	0.01	0.275	1	16.3	2	4.5	12775	1.6E-06
	10000	0.005	0.275	1	16.3	2	4.5	12775	7.8E-07
	18000	0.002	0.275	1	16.3	2	4.5	12775	3.1E-07
	30000	0.001	0.275	1	16.3	2	4.5	12775	1.6E-07
	50000	0.0005	0.275	1	16.3	2	4.5	12775	7.8E-08
	50000+	0.0002	0.275	1	16.3	2	4.5	12775	3.1E-08
	50000++	0.0001	0.275	1	16.3	2	4.5	12775	1.6E-08

Static Smoke

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Inhalation														
	4000	1.0E-02	2.6E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-03	6.4E-05	No	No
	5000	5.0E-03	1.3E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-03	3.2E-05	No	No
	9000	2.0E-03	5.2E-09	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-03	1.3E-05	No	No
	14000	1.0E-03	2.6E-09	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-04	6.4E-06	No	No
	24000	5.0E-04	1.3E-09	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-04	3.2E-06	No	No
	50000	2.0E-04	5.2E-10	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	1.3E-06	No	No
	50000+	1.0E-04	2.6E-10	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	6.4E-07	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987
**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Ingestion													
	7500	1.1E-03	1.0E-05	17.6	22	32	3200	0.5500	6.9E-03	1.9E-03	1.5E-03	No	No
	10000	5.4E-04	5.0E-06	17.6	22	32	3200	0.5500	6.9E-03	9.7E-04	7.3E-04	No	No
	18000	2.1E-04	2.0E-06	17.6	22	32	3200	0.5500	6.9E-03	3.9E-04	2.9E-04	No	No
	30000	1.1E-04	1.0E-06	17.6	22	32	3200	0.5500	6.9E-03	1.9E-04	1.5E-04	No	No
	50000	5.4E-05	5.1E-07	17.6	22	32	3200	0.5500	6.9E-03	9.7E-05	7.4E-05	No	No
	50000+	2.1E-05	2.0E-07	17.6	22	32	3200	0.5500	6.9E-03	3.9E-05	3.0E-05	No	No
	50000++	1.1E-05	1.0E-07	17.6	22	32	3200	0.5500	6.9E-03	1.9E-05	1.5E-05	No	No

*Acute critical effects are weight loss and lesions of theliver, splen, and kidney. Critical Study: Bramachari 1958
**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m²)	Skin Surface Area (m²)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Dermal Absorption														
	7500	1.0E-02	2.8E-01	8.8E-08	2	216	32	320	0.0625	6.8E-01	1.6E-01	1.3E-07	No	No
	10000	5.0E-03	2.8E-01	4.4E-08	2	216	32	320	0.0625	6.8E-01	8.0E-02	6.5E-08	No	No
	18000	2.0E-03	2.8E-01	1.8E-08	2	216	32	320	0.0625	6.8E-01	3.2E-02	2.6E-08	No	No
	30000	1.0E-03	2.8E-01	8.8E-09	2	216	32	320	0.0625	6.8E-01	1.6E-02	1.3E-08	No	No
	50000	5.0E-04	2.8E-01	4.4E-09	2	216	32	320	0.0625	6.8E-01	8.0E-03	6.5E-09	No	No
	50000+	2.0E-04	2.8E-01	1.8E-09	2	216	32	320	0.0625	6.8E-01	3.2E-03	2.6E-09	No	No
	50000++	1.0E-04	2.8E-01	8.8E-10	2	216	32	320	0.0625	6.8E-01	1.6E-03	1.3E-09	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990
**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Mobile Smoke

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Inhalation														
	3000	1.0E-02	7.8E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-03	1.9E-03	No	No
	4000	5.0E-03	3.9E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-03	9.5E-04	No	No
	7000	2.0E-03	1.6E-07	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-03	3.8E-04	No	No
	10000	1.0E-03	7.8E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-04	1.9E-04	No	No
	16000	5.0E-04	3.9E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	2.7E-04	9.5E-05	No	No
	30000	2.0E-04	1.6E-08	60	0.1	32	320	1.88	3.1E-04	4.1E-04	1.1E-04	3.8E-05	No	No
	50000	1.0E-04	7.8E-09	60	0.1	32	320	1.88	3.1E-04	4.1E-04	5.3E-05	1.9E-05	No	No

*Acute critical effect is oil pneumonia. Critical Study: Shinn et al. 1987
**Chronic critical effects are minor lesions of the heart, liver and lungs. Critical Study: Driver et al. 1992

	Distance (m)	Daily Acute Intake Value (g/kg)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Ingestion													
	7500	1.1E-03	1.8E-04	17.6	22	32	3200	0.55	6.9E-03	1.9E-03	2.6E-02	No	No
	10000	5.4E-04	8.9E-05	17.6	22	32	3200	0.55	6.9E-03	9.7E-04	1.3E-02	No	No
	18000	2.1E-04	3.6E-05	17.6	22	32	3200	0.55	6.9E-03	3.9E-04	5.2E-03	No	No
	30000	1.1E-04	1.8E-05	17.6	22	32	3200	0.55	6.9E-03	1.9E-04	2.6E-03	No	No
	50000	5.4E-05	9.0E-06	17.6	22	32	3200	0.55	6.9E-03	9.7E-05	1.3E-03	No	No
	50000+	2.1E-05	3.6E-06	17.6	22	32	3200	0.55	6.9E-03	3.9E-05	5.3E-04	No	No
	50000++	1.1E-05	1.8E-06	17.6	22	32	3200	0.55	6.9E-03	1.9E-05	2.6E-04	No	No

*Acute critical effects are weight loss and lesions of theliver, splen, and kidney. Critical Study: Bramachari 1958
**Chronic critical effect is gastrointestinal irritation. Critical Study: Lewis 1989

	Distance (m)	Daily Acute Intake Value (g/m^2)	Skin Surface Area (m^2)	Dermally absorbed dose (g/kg-day)	*Acute Toxicity Value (g/kg)	**Chronic Toxicity Value (g/kg)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/kg)	Chronic TRV (g/kg)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Dermal Absorption														
	7500	1.0E-02	2.8E-01	1.6E-06	2	216	32	320	0.06	6.8E-01	1.6E-01	2.3E-06	No	No
	10000	5.0E-03	2.8E-01	7.8E-07	2	216	32	320	0.06	6.8E-01	8.0E-02	1.2E-06	No	No
	18000	2.0E-03	2.8E-01	3.1E-07	2	216	32	320	0.06	6.8E-01	3.2E-02	4.6E-07	No	No
	30000	1.0E-03	2.8E-01	1.6E-07	2	216	32	320	0.06	6.8E-01	1.6E-02	2.3E-07	No	No
	50000	5.0E-04	2.8E-01	7.8E-08	2	216	32	320	0.06	6.8E-01	8.0E-03	1.2E-07	No	No
	50000+	2.0E-04	2.8E-01	3.1E-08	2	216	32	320	0.06	6.8E-01	3.2E-03	4.6E-08	No	No
	50000++	1.0E-04	2.8E-01	1.6E-08	2	216	32	320	0.06	6.8E-01	1.6E-03	2.3E-08	No	No

*Acute critical effect is slight to moderate skin irritation. Critical Study: Palmer 1990
**Chronic critical effects are well defined erythema and edema. Critical Study: Lewis 1989

Attachment J: Terephthalic Acid (TPA) Grenades and Smoke Pots - Nursing Indiana Bats

Indiana bat nursing pup risk characterization for TPA exposure under Pasquill Category B.

TPA Smoke Grenades

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation														
	3000	9.0E+00	5.3E-05	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	5.5E-01	Yes	No
	4000	5.0E-03	3.0E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	3.1E-04	No	No
	4000	2.0E-03	1.2E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	1.2E-04	No	No
	4000	1.0E-03	5.9E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	6.1E-05	No	No
	5000	5.0E-04	3.0E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	3.1E-05	No	No
	5000	2.0E-04	1.2E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	1.2E-05	No	No
	6000	1.0E-04	5.9E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	6.1E-06	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

TPA Smoke Pots

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation														
	3000	9.0E+00	1.6E-05	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	1.7E-01	Yes	No
	4000	5.0E-03	9.0E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	9.3E-05	No	No
	5000	2.0E-03	3.6E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	3.7E-05	No	No
	5000	1.0E-03	1.8E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	1.9E-05	No	No
	5000	5.0E-04	9.0E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	9.3E-06	No	No
	6000	2.0E-04	3.6E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	3.7E-06	No	No
	7000	1.0E-04	1.8E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	1.9E-06	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

Indiana bat nursing pup intake for TPA under Pasquill Category B.

TPA Smoke Grenade							nursing pups			
	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	3136	0.049	0.006	2555	5.3E-05
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	3136	0.049	0.006	2555	3.0E-08
	4000	0.002	3.4E-04	1.4E-05	5.9E-07	3136	0.049	0.006	2555	1.2E-08
	4000	0.001	3.4E-04	1.4E-05	5.9E-07	3136	0.049	0.006	2555	5.9E-09
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	3136	0.049	0.006	2555	3.0E-09
	5000	0.0002	3.4E-04	1.4E-05	5.9E-07	3136	0.049	0.006	2555	1.2E-09
	6000	0.0001	3.4E-04	1.4E-05	5.9E-07	3136	0.049	0.006	2555	5.9E-10

TPA Smoke Pots							nursing pups			
	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	950	0.049	0.006	2555	1.6E-05
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	950	0.049	0.006	2555	9.0E-09
	5000	0.002	3.4E-04	1.4E-05	5.9E-07	950	0.049	0.006	2555	3.6E-09
	5000	0.001	3.4E-04	1.4E-05	5.9E-07	950	0.049	0.006	2555	1.8E-09
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	950	0.049	0.006	2555	9.0E-10
	6000	0.0002	3.4E-04	1.4E-05	5.9E-07	950	0.049	0.006	2555	3.6E-10
	7000	0.0001	3.4E-04	1.4E-05	5.9E-07	950	0.049	0.006	2555	1.8E-10

Attachment J: Terephthalic Acid (TPA) Grenades and Smoke Pots - Supplemented Nursing Indiana Bats

Indiana bat supplemented nursing pup intake for TPA under Pasquill Category B.

TPA Smoke Grenade							supplemented nursing			
	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	3136	0.074	0.007	2555	6.9E-05
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	3136	0.074	0.007	2555	3.8E-08
	4000	0.002	3.4E-04	1.4E-05	5.9E-07	3136	0.074	0.007	2555	1.5E-08
	4000	0.001	3.4E-04	1.4E-05	5.9E-07	3136	0.074	0.007	2555	7.7E-09
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	3136	0.074	0.007	2555	3.8E-09
	5000	0.0002	3.4E-04	1.4E-05	5.9E-07	3136	0.074	0.007	2555	1.5E-09
	6000	0.0001	3.4E-04	1.4E-05	5.9E-07	3136	0.074	0.007	2555	7.7E-10

TPA Smoke Pots							supplemented nursing			
	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	950	0.074	0.007	2555	2.1E-05
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	950	0.074	0.007	2555	1.2E-08
	5000	0.002	3.4E-04	1.4E-05	5.9E-07	950	0.074	0.007	2555	4.6E-09
	5000	0.001	3.4E-04	1.4E-05	5.9E-07	950	0.074	0.007	2555	2.3E-09
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	950	0.074	0.007	2555	1.2E-09
	6000	0.0002	3.4E-04	1.4E-05	5.9E-07	950	0.074	0.007	2555	4.6E-10
	7000	0.0001	3.4E-04	1.4E-05	5.9E-07	950	0.074	0.007	2555	2.3E-10

Indiana bat supplemented nursing pup risk characterization for TPA exposure under Pasquill Category B.

TPA Smoke Grenades

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation														
	3000	9.0E+00	6.9E-05	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	7.1E-01	Yes	No
	4000	5.0E-03	3.8E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	4.0E-04	No	No
	4000	2.0E-03	1.5E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	1.6E-04	No	No
	4000	1.0E-03	7.7E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	7.9E-05	No	No
	5000	5.0E-04	3.8E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	4.0E-05	No	No
	5000	2.0E-04	1.5E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	1.6E-05	No	No
	6000	1.0E-04	7.7E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	7.9E-06	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995
**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

TPA Smoke Pots

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging/Roosting Inhalation														
	3000	9.0E+00	2.1E-05	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	2.2E-01	Yes	No
	4000	5.0E-03	1.2E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	1.2E-04	No	No
	5000	2.0E-03	4.6E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	4.8E-05	No	No
	5000	1.0E-03	2.3E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	2.4E-05	No	No
	5000	5.0E-04	1.2E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	1.2E-05	No	No
	6000	2.0E-04	4.6E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	4.8E-06	No	No
	7000	1.0E-04	2.3E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	2.4E-06	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995
**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

Attachment J: Terephthalic Acid (TPA) Grenades and Smoke Pots - Nursing Gray Bats

Gray bat nursing pups intake for TPA under Pasquill Category B.

TPA Smoke Grenade							nursing pups			
	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	1568	0.055	0.0054	3650	2.3E-05
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	1568	0.055	0.0054	3650	1.3E-08
	4000	0.002	3.4E-04	1.4E-05	5.9E-07	1568	0.055	0.0054	3650	5.2E-09
	4000	0.001	3.4E-04	1.4E-05	5.9E-07	1568	0.055	0.0054	3650	2.6E-09
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	1568	0.055	0.0054	3650	1.3E-09
	5000	0.0002	3.4E-04	1.4E-05	5.9E-07	1568	0.055	0.0054	3650	5.2E-10
	6000	0.0001	3.4E-04	1.4E-05	5.9E-07	1568	0.055	0.0054	3650	2.6E-10

	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Maternity Cave Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	3136	0.055	0.0054	3650	4.6E-05
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	3136	0.055	0.0054	3650	2.6E-08
	4000	0.002	3.4E-04	1.4E-05	5.9E-07	3136	0.055	0.0054	3650	1.0E-08
	4000	0.001	3.4E-04	1.4E-05	5.9E-07	3136	0.055	0.0054	3650	5.2E-09
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	3136	0.055	0.0054	3650	2.6E-09
	5000	0.0002	3.4E-04	1.4E-05	5.9E-07	3136	0.055	0.0054	3650	1.0E-09
	6000	0.0001	3.4E-04	1.4E-05	5.9E-07	3136	0.055	0.0054	3650	5.2E-10

Gray bat nursing pups intake for TPA under Pasquill Category B.

TPA Smoke Pots								nursing pups			
	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	475	0.055	0.0054	3650	7.0E-06
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	475	0.055	0.0054	3650	3.9E-09
	5000	0.002	3.4E-04	1.4E-05	5.9E-07	475	0.055	0.0054	3650	1.6E-09
	5000	0.001	3.4E-04	1.4E-05	5.9E-07	475	0.055	0.0054	3650	7.8E-10
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	475	0.055	0.0054	3650	3.9E-10
	6000	0.0002	3.4E-04	1.4E-05	5.9E-07	475	0.055	0.0054	3650	1.6E-10
	7000	0.0001	3.4E-04	1.4E-05	5.9E-07	475	0.055	0.0054	3650	7.8E-11

	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Maternity Cave Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	950	0.055	0.0054	3650	1.4E-05
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	950	0.055	0.0054	3650	7.8E-09
	5000	0.002	3.4E-04	1.4E-05	5.9E-07	950	0.055	0.0054	3650	3.1E-09
	5000	0.001	3.4E-04	1.4E-05	5.9E-07	950	0.055	0.0054	3650	1.6E-09
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	950	0.055	0.0054	3650	7.8E-10
	6000	0.0002	3.4E-04	1.4E-05	5.9E-07	950	0.055	0.0054	3650	3.1E-10
	7000	0.0001	3.4E-04	1.4E-05	5.9E-07	950	0.055	0.0054	3650	1.6E-10

Gray bat nursing pup risk characterization for TPA exposure under Pasquill Category B.

TPA Smoke Grenade

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	3000	9.0E+00	2.3E-05	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	2.4E-01	Yes	No
	4000	5.0E-03	1.3E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	1.3E-04	No	No
	4000	2.0E-03	5.2E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	5.3E-05	No	No
	4000	1.0E-03	2.6E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	2.7E-05	No	No
	5000	5.0E-04	1.3E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	1.3E-05	No	No
	5000	2.0E-04	5.2E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	5.3E-06	No	No
	6000	1.0E-04	2.6E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	2.7E-06	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Inhalation														
	3000	9.0E+00	4.6E-05	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	4.8E-01	Yes	No
	4000	5.0E-03	2.6E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	2.7E-04	No	No
	4000	2.0E-03	1.0E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	1.1E-04	No	No
	4000	1.0E-03	5.2E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	5.3E-05	No	No
	5000	5.0E-04	2.6E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	2.7E-05	No	No
	5000	2.0E-04	1.0E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	1.1E-05	No	No
	6000	1.0E-04	5.2E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	5.3E-06	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

Gray bat nursing pup risk characterization for TPA exposure under Pasquill Category B.

TPA Smoke Pots	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	3000	9.0E+00	7.0E-06	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	7.3E-02	Yes	No
	4000	5.0E-03	3.9E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	4.0E-05	No	No
	5000	2.0E-03	1.6E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	1.6E-05	No	No
	5000	1.0E-03	7.8E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	8.1E-06	No	No
	5000	5.0E-04	3.9E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	4.0E-06	No	No
	6000	2.0E-04	1.6E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	1.6E-06	No	No
	7000	1.0E-04	7.8E-11	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	8.1E-07	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Inhalation														
	3000	9.0E+00	1.4E-05	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	1.5E-01	Yes	No
	4000	5.0E-03	7.8E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	8.1E-05	No	No
	5000	2.0E-03	3.1E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	3.2E-05	No	No
	5000	1.0E-03	1.6E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	1.6E-05	No	No
	5000	5.0E-04	7.8E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	8.1E-06	No	No
	6000	2.0E-04	3.1E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	3.2E-06	No	No
	7000	1.0E-04	1.6E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	1.6E-06	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

Attachment J: Terephthalic Acid (TPA) Grenades and Smoke Pots - Supplemented Nursing Gray Bats

Gray bat supplemented nursing intake for TPA under Pasquill Category B.

TPA Smoke Grenade								supplemented nursing		
	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	1568	0.123	0.0071	3650	4.0E-05
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	1568	0.123	0.0071	3650	2.2E-08
	4000	0.002	3.4E-04	1.4E-05	5.9E-07	1568	0.123	0.0071	3650	8.8E-09
	4000	0.001	3.4E-04	1.4E-05	5.9E-07	1568	0.123	0.0071	3650	4.4E-09
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	1568	0.123	0.0071	3650	2.2E-09
	5000	0.0002	3.4E-04	1.4E-05	5.9E-07	1568	0.123	0.0071	3650	8.8E-10
	6000	0.0001	3.4E-04	1.4E-05	5.9E-07	1568	0.123	0.0071	3650	4.4E-10

	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Maternity Cave Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	3136	0.123	0.0071	3650	7.9E-05
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	3136	0.123	0.0071	3650	4.4E-08
	4000	0.002	3.4E-04	1.4E-05	5.9E-07	3136	0.123	0.0071	3650	1.8E-08
	4000	0.001	3.4E-04	1.4E-05	5.9E-07	3136	0.123	0.0071	3650	8.8E-09
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	3136	0.123	0.0071	3650	4.4E-09
	5000	0.0002	3.4E-04	1.4E-05	5.9E-07	3136	0.123	0.0071	3650	1.8E-09
	6000	0.0001	3.4E-04	1.4E-05	5.9E-07	3136	0.123	0.0071	3650	8.8E-10

Gray bat supplemented nursing intake for TPA under Pasquill Category B.

TPA Smoke Pots										
						supplemented nursing				
	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	475	0.123	0.0071	3650	1.2E-05
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	475	0.123	0.0071	3650	6.6E-09
	5000	0.002	3.4E-04	1.4E-05	5.9E-07	475	0.123	0.0071	3650	2.7E-09
	5000	0.001	3.4E-04	1.4E-05	5.9E-07	475	0.123	0.0071	3650	1.3E-09
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	475	0.123	0.0071	3650	6.6E-10
	6000	0.0002	3.4E-04	1.4E-05	5.9E-07	475	0.123	0.0071	3650	2.7E-10
	7000	0.0001	3.4E-04	1.4E-05	5.9E-07	475	0.123	0.0071	3650	1.3E-10

	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Maternity Cave Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	950	0.123	0.0071	3650	2.4E-05
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	950	0.123	0.0071	3650	1.3E-08
	5000	0.002	3.4E-04	1.4E-05	5.9E-07	950	0.123	0.0071	3650	5.3E-09
	5000	0.001	3.4E-04	1.4E-05	5.9E-07	950	0.123	0.0071	3650	2.7E-09
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	950	0.123	0.0071	3650	1.3E-09
	6000	0.0002	3.4E-04	1.4E-05	5.9E-07	950	0.123	0.0071	3650	5.3E-10
	7000	0.0001	3.4E-04	1.4E-05	5.9E-07	950	0.123	0.0071	3650	2.7E-10

Gray bat supplemented nursing risk characterization for TPA exposure under Pasquill Category B.

TPA Smoke Grenade	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	3000	9.0E+00	4.0E-05	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	4.1E-01	Yes	No
	4000	5.0E-03	2.2E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	2.3E-04	No	No
	4000	2.0E-03	8.8E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	9.1E-05	No	No
	4000	1.0E-03	4.4E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	4.5E-05	No	No
	5000	5.0E-04	2.2E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	2.3E-05	No	No
	5000	2.0E-04	8.8E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	9.1E-06	No	No
	6000	1.0E-04	4.4E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	4.5E-06	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Inhalation														
	3000	9.0E+00	7.9E-05	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	8.2E-01	Yes	No
	4000	5.0E-03	4.4E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	4.5E-04	No	No
	4000	2.0E-03	1.8E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	1.8E-04	No	No
	4000	1.0E-03	8.8E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	9.1E-05	No	No
	5000	5.0E-04	4.4E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	4.5E-05	No	No
	5000	2.0E-04	1.8E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	1.8E-05	No	No
	6000	1.0E-04	8.8E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	9.1E-06	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995

**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

Gray bat supplemented nursing risk characterization for TPA exposure under Pasquill Category B.

TPA Smoke Pots

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	3000	9.0E+00	1.2E-05	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	1.2E-01	Yes	No
	4000	5.0E-03	6.6E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	6.9E-05	No	No
	5000	2.0E-03	2.7E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	2.8E-05	No	No
	5000	1.0E-03	1.3E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	1.4E-05	No	No
	5000	5.0E-04	6.6E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	6.9E-06	No	No
	6000	2.0E-04	2.7E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	2.8E-06	No	No
	7000	1.0E-04	1.3E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	1.4E-06	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995
**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

	Distance (m)	Daily Acute Intake Value (g/m³)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m³)	**Chronic Toxicity Value (g/m³)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m³)	Chronic TRV (g/m³)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Maternity Cave Inhalation														
	3000	9.0E+00	2.4E-05	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.0E+00	2.5E-01	Yes	No
	4000	5.0E-03	1.3E-08	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-04	1.4E-04	No	No
	5000	2.0E-03	5.3E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-04	5.5E-05	No	No
	5000	1.0E-03	2.7E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-04	2.8E-05	No	No
	5000	5.0E-04	1.3E-09	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	5.8E-05	1.4E-05	No	No
	6000	2.0E-04	5.3E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	2.3E-05	5.5E-06	No	No
	7000	1.0E-04	2.7E-10	8.6	8.6	1	30	8.6E+00	2.9E-01	9.7E-05	1.2E-05	2.8E-06	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995
**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

Attachment J: Terephthalic Acid (TPA) Grenades and Smoke Pots - Juvenile Bald Eagles

Bald eagle juvenile intake for TPA under Pasquill Category B.

TPA Smoke Grenade							juvenile			
	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	2242	2	4.5	12775	4.1E-07
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	2242	2	4.5	12775	2.3E-10
	4000	0.002	3.4E-04	1.4E-05	5.9E-07	2242	2	4.5	12775	9.2E-11
	4000	0.001	3.4E-04	1.4E-05	5.9E-07	2242	2	4.5	12775	4.6E-11
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	2242	2	4.5	12775	2.3E-11
	5000	0.0002	3.4E-04	1.4E-05	5.9E-07	2242	2	4.5	12775	9.2E-12
	6000	0.0001	3.4E-04	1.4E-05	5.9E-07	2242	2	4.5	12775	4.6E-12

TPA Smoke Pot										
	Distance (m)	TPA Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Inhalation										
	3000	9	3.4E-04	1.4E-05	5.9E-07	950	2	4.5	12775	1.8E-07
	4000	0.005	3.4E-04	1.4E-05	5.9E-07	950	2	4.5	12775	9.7E-11
	5000	0.002	3.4E-04	1.4E-05	5.9E-07	950	2	4.5	12775	3.9E-11
	5000	0.001	3.4E-04	1.4E-05	5.9E-07	950	2	4.5	12775	1.9E-11
	5000	0.0005	3.4E-04	1.4E-05	5.9E-07	950	2	4.5	12775	9.7E-12
	6000	0.0002	3.4E-04	1.4E-05	5.9E-07	950	2	4.5	12775	3.9E-12
	7000	0.0001	3.4E-04	1.4E-05	5.9E-07	950	2	4.5	12775	1.9E-12

Bald eagle juvenile risk characterization for TPA exposure under Pasquill Category B.

TPA Smoke Grenade

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Inhalation														
	3000	9.0E+00	4.1E-07	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	3.3E+01	1.4E-01	Yes	No
	4000	5.0E-03	2.3E-10	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	1.9E-02	7.6E-05	No	No
	4000	2.0E-03	9.2E-11	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	7.4E-03	3.0E-05	No	No
	4000	1.0E-03	4.6E-11	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	3.7E-03	1.5E-05	No	No
	5000	5.0E-04	2.3E-11	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	1.9E-03	7.6E-06	No	No
	5000	2.0E-04	9.2E-12	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	7.4E-04	3.0E-06	No	No
	6000	1.0E-04	4.6E-12	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	3.7E-04	1.5E-06	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995
**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

TPA Smoke Pot

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Inhalation														
	3000	9.0E+00	1.8E-07	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	3.3E+01	5.8E-02	Yes	No
	4000	5.0E-03	9.7E-11	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	1.9E-02	3.2E-05	No	No
	5000	2.0E-03	3.9E-11	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	7.4E-03	1.3E-05	No	No
	5000	1.0E-03	1.9E-11	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	3.7E-03	6.5E-06	No	No
	5000	5.0E-04	9.7E-12	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	1.9E-03	3.2E-06	No	No
	6000	2.0E-04	3.9E-12	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	7.4E-04	1.3E-06	No	No
	7000	1.0E-04	1.9E-12	8.6	8.6	32	960	2.7E-01	9.0E-03	3.0E-06	3.7E-04	6.5E-07	No	No

*Acute critical effects are necrosis and inflamation of the nasal cavity. Critical Study: Muse et al. 1995
**Chronic critical effects are edema of lungs and emphysema. Critical Study: Muse et al. 1995

Attachment J: Titanium Dioxide Grenades - Nursing Indiana Bats

Indiana bat nursing pup intake for titanium dioxide under Pasquill Category E.

	Distance (m)	Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	100	0.01	3.4E-04	1.4E-05	5.9E-07	48	0.049	0.006	2555	9.0E-10
	300	0.005	3.4E-04	1.4E-05	5.9E-07	48	0.049	0.006	2555	4.5E-10
	500	0.002	3.4E-04	1.4E-05	5.9E-07	48	0.049	0.006	2555	1.8E-10
	700	0.001	3.4E-04	1.4E-05	5.9E-07	48	0.049	0.006	2555	9.0E-11
	1000	0.0005	3.4E-04	1.4E-05	5.9E-07	48	0.049	0.006	2555	4.5E-11
	1400	0.0002	3.4E-04	1.4E-05	5.9E-07	48	0.049	0.006	2555	1.8E-11
	1800	0.0001	3.4E-04	1.4E-05	5.9E-07	48	0.049	0.006	2555	9.0E-12

Indiana bat nursing pup risk characterization for titanium dioxide exposure under Pasquill Category E.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	100	1.0E-02	9.0E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-02	1.7E-03	No	No
	300	5.0E-03	4.5E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-02	8.6E-04	No	No
	500	2.0E-03	1.8E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-03	3.4E-04	No	No
	700	1.0E-03	9.0E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-03	1.7E-04	No	No
	1000	5.0E-04	4.5E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-03	8.6E-05	No	No
	1400	2.0E-04	1.8E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-04	3.4E-05	No	No
	1800	1.0E-04	9.0E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-04	1.7E-05	No	No

*Acute toxicity value assumed equal to unadjusted chronic LOAEL. Acute critical effects are respiratory irritation. Critical Study: Lewis 1992

**Chronic critical effects are respiratory irritation. Critical Study: Lewis 1992

Attachment J: Titanium Dioxide Grenades - Supplemented Nursing Indiana Bats

Indiana bat supplemented nursing pup intake for titanium dioxide under Pasquill Category E.

	Distance (m)	Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging/Roosting Inhalation										
	100	0.01	3.4E-04	1.4E-05	5.9E-07	48	0.074	0.007	2555	1.2E-09
	300	0.005	3.4E-04	1.4E-05	5.9E-07	48	0.074	0.007	2555	5.9E-10
	500	0.002	3.4E-04	1.4E-05	5.9E-07	48	0.074	0.007	2555	2.3E-10
	700	0.001	3.4E-04	1.4E-05	5.9E-07	48	0.074	0.007	2555	1.2E-10
	1000	0.0005	3.4E-04	1.4E-05	5.9E-07	48	0.074	0.007	2555	5.9E-11
	1400	0.0002	3.4E-04	1.4E-05	5.9E-07	48	0.074	0.007	2555	2.3E-11
	1800	0.0001	3.4E-04	1.4E-05	5.9E-07	48	0.074	0.007	2555	1.2E-11

Indiana bat supplemented nursing pup risk characterization for titanium dioxide exposure under Pasquill Category E.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	100	1.0E-02	1.2E-09	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-02	2.2E-03	No	No
	300	5.0E-03	5.9E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-02	1.1E-03	No	No
	500	2.0E-03	2.3E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-03	4.4E-04	No	No
	700	1.0E-03	1.2E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-03	2.2E-04	No	No
	1000	5.0E-04	5.9E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-03	1.1E-04	No	No
	1400	2.0E-04	2.3E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-04	4.4E-05	No	No
	1800	1.0E-04	1.2E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-04	2.2E-05	No	No

*Acute toxicity value assumed equal to unadjusted chronic LOAEL. Acute critical effects are respiratory irritation. Critical Study: Lewis 1992

**Chronic critical effects are respiratory irritation. Critical Study: Lewis 1992

Attachment J: Titanium Dioxide Grenades - Nursing Gray Bats

Gray bat nursing pup intake for titanium dioxide under Pasquill Category E.

	Distance (m)	Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging Inhalation										
	100	0.01	3.4E-04	1.4E-05	5.9E-07	24	0.055	0.0054	3650	3.9E-10
	300	0.005	3.4E-04	1.4E-05	5.9E-07	24	0.055	0.0054	3650	2.0E-10
	500	0.002	3.4E-04	1.4E-05	5.9E-07	24	0.055	0.0054	3650	7.9E-11
	700	0.001	3.4E-04	1.4E-05	5.9E-07	24	0.055	0.0054	3650	3.9E-11
	1000	0.0005	3.4E-04	1.4E-05	5.9E-07	24	0.055	0.0054	3650	2.0E-11
	1400	0.0002	3.4E-04	1.4E-05	5.9E-07	24	0.055	0.0054	3650	7.9E-12
	1800	0.0001	3.4E-04	1.4E-05	5.9E-07	24	0.055	0.0054	3650	3.9E-12

Gray bat nursing pup risk characterization for titanium dioxide exposure under Pasquill Category E.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	100	1.0E-02	3.9E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-02	7.5E-04	No	No
	300	5.0E-03	2.0E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-02	3.8E-04	No	No
	500	2.0E-03	7.9E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-03	1.5E-04	No	No
	700	1.0E-03	3.9E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-03	7.5E-05	No	No
	1000	5.0E-04	2.0E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-03	3.8E-05	No	No
	1400	2.0E-04	7.9E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-04	1.5E-05	No	No
	1800	1.0E-04	3.9E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-04	7.5E-06	No	No

*Acute toxicity value assumed equal to unadjusted chronic LOAEL. Acute critical effects are respiratory irritation. Critical Study: Lewis 1992

**Chronic critical effects are respiratory irritation. Critical Study: Lewis 1992

Attachment J: Titanium Dioxide Grenades - Supplemented Nursing Gray Bats

Gray bat supplemented nursing pup intake for titanium dioxide under Pasquill Category E.

	Distance (m)	Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Foraging Inhalation										
	100	0.01	3.4E-04	1.4E-05	5.9E-07	24	0.123	0.0071	3650	6.7E-10
	300	0.005	3.4E-04	1.4E-05	5.9E-07	24	0.123	0.0071	3650	3.4E-10
	500	0.002	3.4E-04	1.4E-05	5.9E-07	24	0.123	0.0071	3650	1.3E-10
	700	0.001	3.4E-04	1.4E-05	5.9E-07	24	0.123	0.0071	3650	6.7E-11
	1000	0.0005	3.4E-04	1.4E-05	5.9E-07	24	0.123	0.0071	3650	3.4E-11
	1400	0.0002	3.4E-04	1.4E-05	5.9E-07	24	0.123	0.0071	3650	1.3E-11
	1800	0.0001	3.4E-04	1.4E-05	5.9E-07	24	0.123	0.0071	3650	6.7E-12

Gray bat supplemented nursing pup risk characterization for titanium dioxide exposure under Pasquill Category E.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Foraging Inhalation														
	100	1.0E-02	6.7E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-02	1.3E-03	No	No
	300	5.0E-03	3.4E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-02	6.4E-04	No	No
	500	2.0E-03	1.3E-10	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-03	2.6E-04	No	No
	700	1.0E-03	6.7E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-03	1.3E-04	No	No
	1000	5.0E-04	3.4E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-03	6.4E-05	No	No
	1400	2.0E-04	1.3E-11	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-04	2.6E-05	No	No
	1800	1.0E-04	6.7E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-04	1.3E-05	No	No

*Acute toxicity value assumed equal to unadjusted chronic LOAEL. Acute critical effects are respiratory irritation. Critical Study: Lewis 1992

**Chronic critical effects are respiratory irritation. Critical Study: Lewis 1992

Attachment J: Titanium Dioxide Grenades - Juvenile Bald Eagles

Bald eagle juvenile intake for titanium dioxide under Pasquill Category E.

	Distance (m)	Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Summer Inhalation										
	100	0.01	3.4E-04	1.4E-05	5.9E-07	48	2	4.5	12775	9.8E-12
	300	0.005	3.4E-04	1.4E-05	5.9E-07	48	2	4.5	12775	4.9E-12
	500	0.002	3.4E-04	1.4E-05	5.9E-07	48	2	4.5	12775	2.0E-12
	700	0.001	3.4E-04	1.4E-05	5.9E-07	48	2	4.5	12775	9.8E-13
	1000	0.0005	3.4E-04	1.4E-05	5.9E-07	48	2	4.5	12775	4.9E-13
	1400	0.0002	3.4E-04	1.4E-05	5.9E-07	48	2	4.5	12775	2.0E-13
	1800	0.0001	3.4E-04	1.4E-05	5.9E-07	48	2	4.5	12775	9.8E-14

	Distance (m)	Concentration (g/m3)	Intake Rate (m^3/day)			EF (event/yr)	ED (yrs)	BW (kg)	AT (days)	Daily Chronic Intake Value (g/kg-day)
			Daily IR	Hourly IR	Event IR					
Winter Inhalation										
	100	0.01	3.4E-04	1.4E-05	5.9E-07	48	2	4.5	12775	9.8E-12
	300	0.005	3.4E-04	1.4E-05	5.9E-07	48	2	4.5	12775	4.9E-12
	500	0.002	3.4E-04	1.4E-05	5.9E-07	48	2	4.5	12775	2.0E-12
	700	0.001	3.4E-04	1.4E-05	5.9E-07	48	2	4.5	12775	9.8E-13
	1000	0.0005	3.4E-04	1.4E-05	5.9E-07	48	2	4.5	12775	4.9E-13
	1400	0.0002	3.4E-04	1.4E-05	5.9E-07	48	2	4.5	12775	2.0E-13
	1800	0.0001	3.4E-04	1.4E-05	5.9E-07	48	2	4.5	12775	9.8E-14

Bald eagle juvenile risk characterization for titanium dioxide exposure under Pasquill Category E.

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Summer Inhalation														
	100	1.0E-02	9.8E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-02	1.9E-05	No	No
	300	5.0E-03	4.9E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-02	9.4E-06	No	No
	500	2.0E-03	2.0E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-03	3.7E-06	No	No
	700	1.0E-03	9.8E-13	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-03	1.9E-06	No	No
	1000	5.0E-04	4.9E-13	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-03	9.4E-07	No	No
	1400	2.0E-04	2.0E-13	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-04	3.7E-07	No	No
	1800	1.0E-04	9.8E-14	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-04	1.9E-07	No	No

*Acute toxicity value assumed equal to unadjusted chronic LOAEL. Acute critical effects are respiratory irritation. Critical Study: Lewis 1992

**Chronic critical effects are respiratory irritation. Critical Study: Lewis 1992

	Distance (m)	Daily Acute Intake Value (g/m^3)	Daily Chronic Intake Value (g/kg-day)	*Acute Toxicity Value (g/m^3)	**Chronic Toxicity Value (g/m^3)	Acute TRV Uncertainty Adjustment	Chronic TRV Uncertainty Adjustment	Acute TRV (g/m^3)	Chronic TRV (g/m^3)	Chronic Dose Adjusted TRV (g/kg-day)	Acute Hazard Quotient	Chronic Hazard Quotient	Acute Effect	Chronic Effect
Winter Inhalation														
	100	1.0E-02	9.8E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-02	1.9E-05	No	No
	300	5.0E-03	4.9E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-02	9.4E-06	No	No
	500	2.0E-03	2.0E-12	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-03	3.7E-06	No	No
	700	1.0E-03	9.8E-13	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-03	1.9E-06	No	No
	1000	5.0E-04	4.9E-13	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	2.0E-03	9.4E-07	No	No
	1400	2.0E-04	2.0E-13	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	8.0E-04	3.7E-07	No	No
	1800	1.0E-04	9.8E-14	0.25	0.25	1	160	2.5E-01	1.6E-03	5.3E-07	4.0E-04	1.9E-07	No	No

*Acute toxicity value assumed equal to unadjusted chronic LOAEL. Acute critical effects are respiratory irritation. Critical Study: Lewis 1992

**Chronic critical effects are respiratory irritation. Critical Study: Lewis 1992